1. OBJECT LESSON PICTURES AND DIAGRAMS, No. 3.—THE HEDGEHOG.
2. TWO GOVERNMENT EXAMINATION TESTS—DRAWING.

No. 10.—Vol. 16.
April, 1896.

The Practical Teacher

Price Sixpence.

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'Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more.'—COWPER.

VOL. XVI. NO. 10. APRIL, 1896. PRICE, 6D. POST FREE, 8D.

FULL NOTES OF A LESSON ON THE HEDGEHOG.

(*See Supplement presented with this Number.*)

BY WILLIAM DONE, B.A.,
Head-Master of the Brighton Pupil Teacher School.

Class—Standard VI. or VII. *Time*—40 minutes.

N.B.—The picture accompanying this number of the 'PRACTICAL TEACHER' is designed to illustrate 'Circular 369' of the Education Department, in which a most admirable scheme of Object Lessons is drawn up. The Hedgehog is one of these approved objects, and is sketched out thus :—'Hedgehog : Covering of spines ; how it rolls itself into a ball, and why ; head, teeth, food.'

HEADS.	MATTER AND METHOD.
I.—*Introduction.* Its name and the reason. A snout like a pig and frequents thickets or hedges.	Perhaps in addition to the picture it might be possible to borrow a hedge-hog. Even in towns there may be a shop in the neighbourhood, dear to the hearts of boys, which sells such things, and the proprietor, if he has a hedgehog on hand, would lend it for a few pence for the afternoon. It has a snout like a pig, and lives in thickets or hedgerows—hence its name.
II.—More detailed observation. (1.) Size. (2.) Appearance.	As the hedgehog attains a length of about eleven inches, the picture will give the class a pretty correct idea of its size. Let the children examine the picture and state in their own words the results of their observation :—the spiny covering, short legs, apparent absence of tail, the food it is seeking, the rolled-up ball.
III.—The cover of spines.	The prickly covering of the hedgehog will be the first thing commented upon by the children.
The enlarged diagram examined.	These spines are about an inch in length, but we have in the left-hand corner of the picture a diagram of one very much enlarged. Call attention to the shape of the root of the spine.
	The colour is a dingy-white, except where the dark transverse band occurs.
IV.—How the spines become erect.	Take a pin and stick it through a handkerchief up to the head. By laying the handkerchief flat, and stretching it between our two fingers on each side of the pin, we cause the latter to stand bolt upright ; by relaxing, the pin falls pretty flat.
Diagram 2 examined.	Now examine diagram number two. A very similar process goes on with the hedgehog. Point out the broad band of muscle passing round the body, just underneath the skin. What will be the effect if the muscular band contracts ? Illustrate by a child's arm. Show the contraction of the biceps muscle draws up the fore-arm. So the hedgehog is drawn up into the shape of a ball. Now the skin being thus tightened, the spines act just as our pin did—they stick upright.
V.—Why the spines become erect. (1) A protection against its enemies.	The use of this action may partly be elicited. The hedgehog has only short legs, and could not run away from many of his enemies, such as the dog or fox. Picture how surprised and disgusted the dog looks when he suddenly finds a round spiky ball where he thought he had something like a nice, big rat. Sometimes, however, the sharp dog warily rolls Mr. Hedgehog along to a ditch or pond, and when he unrolls himself to see what is the matter, the dog does not give him another chance to roll up.
(2) A guard against the effect of falling from a height.	The teacher would state another use in the erection of the spines. The animal thus rolled up can tumble down a good distance without hurting itself.
VI.—The head of the hedgehog. Diagram 3. The teeth compared with ours.	Refer to enlarged diagram number three. Notice the teeth. Which are meant for cutting and biting, and which for grinding the food ? Show similar teeth in ourselves. But in the hedgehog the cutting and tearing teeth project considerably, thus helping it to pick up such small things as beetles (*See* Picture). Point out the cusps and hollows of the molar teeth—a pestle and mortar arrangement for grinding the food.
VII.—The feet.	Look at the enlarged diagram of the foot. Compare the claws with those of the dog and the cat.
VIII.—Its food.	That the hedgehog likes beetles as food the children will already know. Also that people sometimes keep hedgehogs to rid the house of both cockroaches and beetles. It feeds, too, on slugs, worms, frogs, and even snakes. The bite of poisonous reptiles apparently does not affect it. When kept in the house it will eat raw or cooked flesh, boiled vegetables, or soaked bread.

Heads.	Matter and Method.
IX.—Other characteristics. (1) Its nest.	Tell the class that the hedgehog makes its nest in a hole under a rock or stump, and lines it well with grass and leaves.
(2) Its hibernating habit.	In the winter it lives in a torpid state. Compare other hibernating animals.
(3) Where found.	It is found in Great Britain, in fact it is our only English animal guarded with spikes; and it occurs in Europe generally.
(4) It is easily tamed.	If kept in a house it is soon tamed, and will allow one to handle it without curling up.
(5) Its young ones.	The young ones, from four to eight in number, are born blind, and have no spines at first, but only a hairy covering.

FRENCH PRIMARY SCHOOLS.

BY STEWART A. ROBERTSON, M.A.,
English Master, Stirling High School.

II.

A French Normal School.

Each Department of France has a training college for men teachers and one for women teachers. That for the department in which Paris is situated is at Auteuil, a pleasant suburban quarter where quietude for study is secured, and where there is yet such proximity to Paris as secures the services of the best professors. Auteuil Normal School is the eldest child of the Third Republic; its institution was decreed during the siege of Paris, and it was opened in 1872. Thus earnestly, in the very hour of defeat, did France set herself to that task of regeneration, in which her new educational system has been the most powerful agent.

The college is situated in a wide-spreading park, with fine trees, lawns, and recreation grounds, though there is not much athleticism in French training colleges. There could not be, for Sunday and Thursday afternoon are the only continuous periods of relaxation from head work.

The candidate who is successful in passing the entrance examination knows that his lodging, board, etc. are secured to him for three years, the period of study, and that even pocket-money will be granted to him by a beneficent State, but he will find that this is entirely on the condition, rigidly exacted, of steadfast and unceasing work.

Candidates enter at the age of sixteen, some even at fifteen. Here is the day's programme at Auteuil: Rise at five, study till seven, breakfast and recreation till nine, classes till eleven, lunch and recreation till one, classes till four, recreation and dinner till six, study till nine; in all, ten hours for study, eight hours for sleep, six hours for meals and recreation. But the last is somewhat cut down by the claims of gymnastic and manual training, and by the bed-making, room-cleaning, and, at certain intervals, floor-polishing, which are duties imposed upon every student. When he has free recreation-time, however, there is everything to amuse him, out of doors and in, garden, billiard-room, and library. The latter is marvellously well supplied, for both France and Germany have realised, as we have never yet done, that the life of all educational establishments depends upon a well-filled library and the wise use of it. There is no studying during sleeping hours, but the periods set apart for studies are rigorously made periods of real working by the continual presence of the *maître répétiteur*. Further, a functionary called the *surveillant* has nothing to do all day but to wander about and appear unexpectedly in class-rooms, studies, workshops, and even recreation-rooms, with a view to detecting anything that may call for a 'black mark' against the offender's name.

The marking system is most elaborate. Every time a student answers in class, marks are assigned to him, and for every exercise marks are awarded. These are considered in a monthly meeting of the *professeurs* of the college, and if the total, diminished by the *surveillant's* 'black marks,' is less than half the possible total, the student concerned may be instantly expelled, whilst those who approximate to the line of danger are severely reprimanded. That there is iron in the system one cannot but feel, on seeing how a French normal student trembles before his lecturers, and still more before the supreme *proviseur*.

Auteuil, like all the training colleges of the French Government, is strictly neutral with regard to religious observances. It gives moral instruction as part of its course, but no one enquires how Sunday is spent. Some students go to mass; some to Paris, as the only opportunity afforded of spending their pocket-money; some read. There is complete freedom of option. One cannot but feel that the life is a cloistered and military one, and that the continual insistence upon educational matters solely must have a very narrowing effect. The subjects of study, variously modified for each of the three years, are the subjects of the primary school in fuller measure, with the addition of a foreign language and the theory of education. History ranks as an important subject. Frenchmen do not consider that one may at any time 'drop' history, and they think it not unimportant that the teachers of primary schools should have some knowledge of the history of Greece and of Egypt, though they are never to teach it, and that they should be guaranteed accurate ideas about Mahomet by being instructed concerning his work. As their Code says, it is the development of civilisation which they seek to know. In the theory of education the course proceeds from psychology in the first year to the study of ethics in the second, till both find their result and application in the theory and practice of education, the assigned task of the third year. In the Practising School, an intermediate department is entrusted to the charge of the third year's students, to each of whom a second year's man and a first year's man are attached. Criticism lessons are given only by students of the third year, but students of the second year are frequently asked in class to correct some written exercise which has been done by a pupil. He has to justify his corrections to his fellows, and to suggest methods of correcting in the pupil the error the exercise has revealed. Arithmetic is dropped after the first year, and its place is taken by Algebra and Book-keeping. Science bulks largely in the curriculum, especially in the second and third years. Physics and Chemistry are taken in all the years for three hours a week. Of the natural sciences Botany claims the first year, though all the students are expected to attend the frequent botanical excursions which fill many of the vacant Thursday afternoons. Zoology is taken in the second year, and Geology and

Hygiene in the third. As a foreign language men usually take German, women English. (Such is the usual division in France, so that the soldier may easily find his way to Berlin.) As of special interest it might be noted that exercises in calculation in the foreign language are given, extracts from foreign educational journals are read, and songs are sung in the foreign tongue. Second-year students study Agriculture, while third-year men advance to Horticulture, which, in some departments, becomes the theory of vine cultivation. Gymnastics become, in the third year, really military training, including shooting at a target, and all have ambulance lessons. Manual work includes working in wood and iron, and also clay-modelling, which rises in the final stage to become, as the Code phrases it, 'rudimentary exercises in sculpture.'

During the three years filled with so varied work, there is no extra-mural examination, but the end of the third year makes all anxious, as there draws near the time of the examination for the certificate which will confer the proud title of *Instituteur* upon the successful candidates. This certificate obtained, the educational authorities assume the task of finding a post for each one where his special fitness may be best made use of. Further advance depends upon the way in which the work thus entered upon is performed.

Such is the framework of the Normal School system. The spirit of it is more difficult to suggest by description. Yet how high is its ideal may be inferred from the words of lofty wisdom that the teacher's diploma employs concerning his function, and the earnestness with which it reminds him to ask himself every evening, 'What have I done for France to-day?'

(To be continued.)

WELL-KNOWN TEACHERS AT WORK.

No. XLVIII.—MR. W. J. PROSSER,

Head Master, Bathforum British School, Bath.

THERE is certainly no primary teacher in the West of England better known or more highly respected than the subject of our sketch this month, Mr. W. J. Prosser, of the Bathforum British School, Bath.

Mr. Prosser commenced his career as a teacher at Woodhill School in the fifties, where he served five years as a pupil teacher. This was then, as it is now under its new name of Westfield School, a really excellent rural school; horticulture was taught to the boys, and cookery to the girls, and the school was generally considered a model one. All the teachers lived on the premises, and the lessons to the pupil teachers were given by the Head Master from 6 to 7.30 a.m. all the year round. Mr. Prosser attributes much of his success in life to the excellent training he received there. After serving a year in the same school as ex-Pupil Teacher, the 13th position in the first-class Queen's Scholarship list was gained, and Mr. Prosser became a student at the Metropolitan Training College, Highbury, in 1861. This college was closed in 1863, and very few Highbury men are now left in the profession.

After leaving college, Mr. Prosser became the Master of the Woodhill School—where he had been a Pupil Teacher—holding this position till 1865. He was next appointed to the Elizabethan (Free) School, Fulham. From here he removed to Bath and took charge of the Widcombe Boys' School. During his mastership the school flourished, and the building had to be enlarged to meet the wants of the largely increased numbers. In 1877 the important post of Head Master of the Bathforum British School became vacant, and Mr. Prosser, who had made a reputation in Bath, was invited by the managers to fill the vacancy. Again Mr. Prosser's energy and strong personality made themselves felt; the school rapidly increased in numbers, till in 1890 the managers improved and enlarged the premises to accommodate about four hundred boys—a large school for this part of the country. The maintenance and growth of the school is the more remarkable from the absence of any 'feeder,' there being no Infant Department. Standard I., at the beginning of the school year has, perhaps, half-a-dozen in it, but at the end of the year these have increased to fifty or sixty.

The upper standards are large, there being always a good class of Standard VII. and Ex-VII. In addition to the ordinary subjects, Algebra has been taken as a specific subject for many years, and has not only invariably gained the highest grants, but on many occasions has been mentioned in high terms of praise in H.M.I.'s reports. Mr. Prosser is of opinion that in the upper standards the labour of teaching Algebra is well repaid by the increased facility with which the lads work their Arithmetic.

Drawing and Map-drawing are two special features of the school. The maps, produced in colours, are among the very best we have ever seen. The older boys also regularly draw with chalks on the blackboard—the walls having fixed blackboards along their whole length for this purpose.

On the day of our visit about a dozen maps of South America were thus on the boards, drawn with a neatness and accuracy surprising to one not accustomed to see such work.

Mr. Prosser was the first teacher in Bath to incorporate 'wood-work' in the school curriculum. In reply to a question he said,—

'I am of opinion that wherever the staff, size of the class, and other circumstances warrant it, not only is "wood-work" a valuable educational exercise for the elder boys, but by it the natural "bent" of a boy often shows itself. I have no sympathy with the paper-snipping and other time-wasting devices for the lower standards, as I believe that drawing and properly arranged lessons in other subjects give quite "varied occupation" enough. I rejoice at the recent decision of the Department to make "Varied Occupations" optional.'

It will readily be imagined that the school is popular in the city. It is a good character in itself that a boy can say he has been educated at the Bathforum School. Old boys are filling important and responsible situations, not only in Bath but throughout the country. Many excellent teachers owe their success to this school—one pupil teacher, also from the Woodhill School, became the Normal Master at his college, and is now a Sub-Inspector.

A glance at the well-filled rooms reveals the fact that the boys mostly belong to the respectable artisan and small shopkeeping class. One has not to be long in the school to be able to detect the excellent tone, quiet, effective discipline, the good feeling between teachers and boys—they are everywhere apparent. The staff consists of the Head

BATHFORUM BRITISH SCHOOL, BATH.

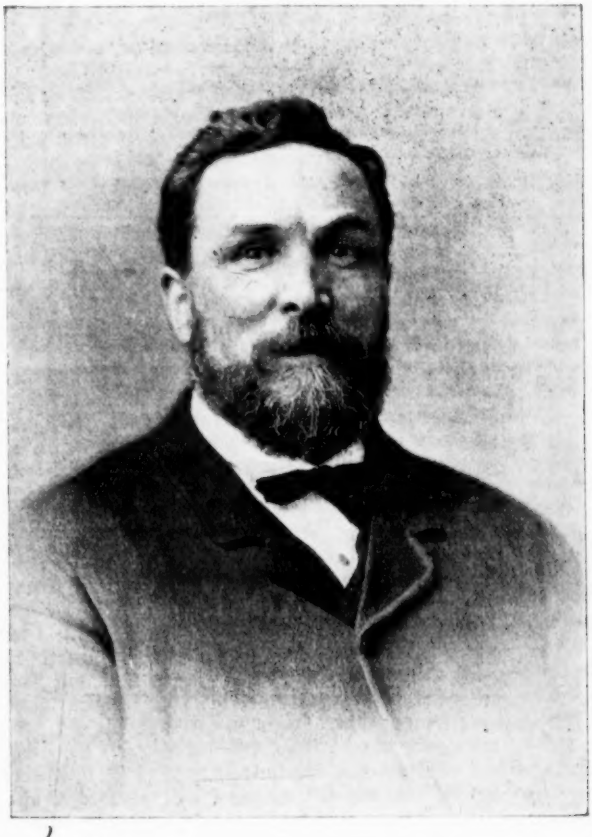
TIME TABLE.

		MORNING.						AFTERNOON.					
DAYS.	Standards.	9— 9.35.	to 9.40.	to 10.15.	to 10.55.	to 11.5.	to 11.45.	to 12.25.	to 12.30—	2— 2.10.	to 2.55.	to 3.35.	to 3.45.	to 4.25.	to 4.30.
MONDAY	VII. & VI.	Assembly—Prayers—Bible Lesson.	Marking Registers.	Revn. of Home Less.	Geography	Interval—Marching, &c.	Arithmetic	Copy Books	Dismissal.	Assembly—Marking Registers.	Algebra	Grammar	Interval—Marching, &c.	Drill taken in alter. wks. Drill or Rdg.	Prayers and Dismissal.
	V.			Revn. of Home Less.	Arithmetic		Copy Books	Composition			Algebra	Geography		Drill or Rdg.	
	IV.			Revn. of Home Less.	Reading		Copy Books	Arithmetic			Drawing	Dictation		Drill or Geo.	
	III.			Revn. of Home Less.	Reading		Copy Books	Arithmetic			Reading	Dictation		Drill or Geo.	
	II.			Revn. of Home Less.	Copy Books		Arithmetic	Reading			Dictation	Reading		Drill or Geo.	
	I.			Reading	Arithmetic		Drawing	Trans. & Spell.			Copy Books	Arithmetic		Reading	
TUESDAY	VII. & VI.			Revn. of Home Less.	Composition		Arithmetic	Copy Books			Drawing	Grammar		Reading	
	V.			Revn. of Home Less.	Arithmetic		Gram. (written)	Recitation			Drawing	Grammar		Reading	
	IV.			Revn. of Home Less.	Reading		Copy Books	Grammar			Reading	Dictation		Arith. (paper)	
	III.			Revn. of Home Less.	Reading		Copy Books	Arithmetic			Drawing	Grammar		Arith. (paper)	
	II.			Revn. of Home Less.	Copy Books		Drawing	Arithmetic			Dictation	Reading		Arith. (paper)	
	I.			Reading	Arithmetic		Geography	Trans. & Spell.			B.B. Writing	Arithmetic		Reading	
WEDNESDAY	VII. & VI.			Revn. of Home Less.	Recitation		Arithmetic	Copy Books			Arith. (paper)	B.B. Drawing		Reading	
	V.			Revn. of Home Less.	Geography		Arithmetic	Composition			Reading	B.B. or Gram.		Arith. (paper)	
	IV.			Revn. of Home Less.	Recitation		Copy Books	Arithmetic			Reading	Dictation		Geography	
	III.			Revn. of Home Less.	Recitation		Copy Books	Arithmetic			Reading	Dictation		Geography	
	II.			Revn. of Home Less.	Grammar		Arithmetic	Recitation			Dictation	Reading		Geography	
	I.			Reading	Arithmetic		Recitation	Trans. & Spell.			Copy Books	Arithmetic		Reading	
THURSDAY	VII. & VI.			Revn. of Home Less.	Mapping (plain)		Arithmetic	Singing or Algebra in alternate weeks.			Algebra	to 3.5	to 3.25 Singing	to 4.25 Drawing	
	V.			Revn. of Home Less.	Arithmetic		Grammar				Algebra		Singing	Drawing	
	IV.			Revn. of Home Less.	Reading		Dictation	Reading			Drawing		Singing	Arithmetic	
	III.			Revn. of Home Less.	Reading		Dictation	Arithmetic			Drawing		Arithmetic	Singing	
	II.			Revn. of Home Less.	Copy Books		Arithmetic	Reading, Singing (alternate weeks)			Drawing		Arithmetic	Singing	
	I.			Reading	Trans. & Spell.		Geography	Arithmetic			B.B. Writing		Arithmetic	Singing	
FRIDAY	VII. & VI.			Revn. of Home Less.	Gram. (written)		Geography	Arith. (paper)			Grammar		Woodwork * and Coloured Maps		
	V.			Revn. of Home Less.	Arithmetic		Copy Books	Grammar			Reading				
	IV.			Revn. of Home Less.	Reading		Mapping	Arithmetic			Reading		Oral Spelling (recapitulation)	Geography	
	III.			Revn. of Home Less.	Reading		Grammar	Arithmetic			Reading		Oral Spelling (recapitulation)	Geography	
	II.			Revn. of Home Less.	Copy Books		Arithmetic	Reading			Dictation		Reading	Geography	
	I.			Reading	Arithmetic		Reading	Trans. & Spell.			Drawing		Arithmetic	Reading	

N.B.—In Standards I. and II. Grammar is entirely taught in connection with Reading Lessons.
In Standards III. and IV. Grammar is mainly taught in connection with Reading Lessons.

* A section of the Class receives instruction at the Technical School.

Master, four assistants, and two pupil teachers, and they are all workers. To the loyal support and zealous work of the Senior Assistant, Mr. C. Harper, who has been on the staff much longer than the Head Master, Mr. Prosser feels that much of the success of the school is attributable. Mr. Prosser is no believer in 'Royal roads' to learning, and considers the blackboard, duster, and chalk to be the best apparatus. The school-buildings are, according to modern ideas, inconvenient, the great drawback being the lack of a suitable playground, and as the school is surrounded by houses built close up to it, this defect cannot be remedied. There are three good class-rooms and the main room with block floor, and all heated by hot-water apparatus. The managers have thus done what they can to make the building as good as circumstances will permit.



Mr. Prosser is proud of his military drill, and well he may be, for it is seldom that boys present a smarter appearance or go through the various movements with greater precision. Mr. Prosser himself is a great believer in all kinds of athletics. A cricketer as a pupil teacher and in college, he was able, when he went to Fulham in 1866, to establish a club, and was elected its first captain. We find him too at that time a member of the South Middlesex Rifle Volunteers. He became a marksman, and in the Fenian scare of 1867 was a sergeant of special constables, with a squad of twelve men to look after if their services were required, which happily they were not. In Bath he gained some reputation as a bowler for one of the leading clubs. Possibly it is to these athletic influences that Mr. Prosser owes his robust, powerful-looking, well-set-up body, which makes him a conspicuous figure in any assembly. He has a staunch belief in the power of out-door exercise as an antidote to the brain-worker's ills, and thinks walking one of the best forms of such exercise.

Questioned as to the scholarships earned by the school, Mr. Prosser modestly replied that the boys had gained some. On consulting the Bath records, however, we found that a very large number, in fact nearly all the scholarships at the Grammar School and the Technical School, had been won by Bathforum boys. The Bath Technical School calls for more than a passing reference in connection with Mr. Prosser. He was early appointed by the Corporation a member of the Bath Technical Committee, and has taken an active part in all its work. He was chairman of a committee of citizens appointed to draw up a memorial to the School Board, asking that body to establish a secondary school at such fees as would attract the children of the working classes. The School Board, having no building available, was not able to start such a school, but expressed itself in favour of such a scheme, and offered to support the Technical Committee in providing a building, etc. A scheme was then prepared by this Committee, and, after considerable amendment, was finally adopted. The scheme provides that the fee shall be half-a-guinea a term, and there are also many free scholarships. The course of studies is arranged for three years. A splendid building is in the course of erection, and will shortly be completed. The successful issue of the efforts to provide this school has been largely brought about by Mr. Prosser.

The pupil teachers' classes in Bath are to be taught by the staff of, and in connection with, this new school.

It need hardly be said that Mr. Prosser is on excellent terms with the managers of his school, a body which consists of nineteen prominent Bath citizens, with Dr. Tuckett as Chairman, Mr. J. I. Titley, Treasurer, and Mr. J. E. Sturges, Hon. Secretary.

Judging from the enthusiastic terms in which a vote of thanks to Mr. Prosser was moved and received at the last annual meeting, the feeling of respect which he entertains for the managers is fully reciprocated by that body. Mr. Sturges in moving the vote said, 'Mr. Prosser is the best elementary teacher in Bath.'

This annual meeting of the school has become one of the educational events of Bath. The Mayor of the city has on many occasions presided, and at the last meeting on July 12, 1895, His Worship, W. C. Jolly, Esq., in the course of his speech, said that he considered the good work done in the Bathforum School would be of incalculable benefit to the city in after years. He took the opportunity of publicly thanking Mr. Prosser and his staff for the good work they were doing.

An excellent prize scheme is in force in the school, and the prizes are awarded at the annual meeting. In addition to the ordinary prizes, valuable special prizes are offered by various Bath gentlemen for special subjects, among these being Mr. S. Fox Andrews' prize for Conduct, Mr. A. Archard's for Composition, Mr. T. B. Silcock's for Arithmetic and Algebra, and Mr. S. Bush's for Woodwork.

These special prizes are great incentives to the boys and teachers, and are also additional evidence of the appreciation of the school by the citizens.

The opinion of Her Majesty's Inspectors fully agrees with the public estimate of the school, as shown by the reports, a few of the most recent of which we append:—

'The result of the examination in elementary work was satisfactory and creditable. Geography and Mental Arithmetic were good. Maps were well drawn.'

'This large school is orderly, the Drill and Mental Arithmetic are good, and the results of the examination in elementary work satisfactory and creditable. Writing and Mapping are particularly good. Geography is good. The specific subject, Algebra, was well done.'

'This large school is in good order, well and ably taught, and passed a creditable examination in elementary work. Mental Arithmetic was especially good in the fourth and upper standards. English and Geography were good.'

'The boys are orderly, carefully and intelligently taught, the Singing is good, and the results of the examination very creditable, especially taking into account the prevalence of influenza. Class subjects are good and intelligently known, maps being unusually well done.'

'The boys are in good order, and the Military Drill is good. The results of the examination in elementary work were very creditable, the scholars fully coming up to the new requirements in Arithmetic. Class subjects were well known. Algebra good.'

'Very good order prevails in the school, and both teachers and scholars appear to be much interested in their work. The boys' attainments in the elementary subjects are, for the most part, highly satisfactory, the work being both accurate and intelligent. A large proportion of the scholars have successfully grappled with the arithmetical problems, their success in this branch of their work being no doubt due to the special attention that has been given to Oral Arithmetic. The instruction in the two class subjects, English and Geography, and in the specific subject, Algebra, has been thoroughly sound and effective, and the boys have drawn some remarkably good maps.'

'The boys set about their work with vigour and determination. They have mastered what they have been taught, and performed the exercises given them carefully and correctly. The Writing and Composition are alike creditable, and Arithmetic also. Reading and Recitation are both very good. Care has been taken to see that the scholars understand what they learn by judicious exercises in mental calculations and by the methods used in the class lessons.'

Having noticed that the school was excused examination, under Art. 84, after the last report, we asked Mr. Prosser's opinion of the new mode of inspection. He replied, 'I desire to reserve my judgment until I have had a longer actual experience under it. Carried out in the spirit with which the regulation was framed, and with wise, considerate, and sympathetic inspectors, the new method will prove advantageous, inasmuch as it will

give the teacher greater freedom to really teach and train his children according to his own ideas. More than this I cannot say.'

In reply to our query whether Mr. Prosser was a member of the N.U.T., and what he thought of the work of that body, he replied: 'Union among teachers is their one means of salvation. Twenty years ago I assisted to start the Bath Teachers' Association, and have twice filled the presidential chair. I am now vice-president for the third time. I am also president of the Somerset Teachers' Federation, and during the past year have addressed meetings at Weston-super-Mare, Taunton, Shepton-Mallett, Wells, Yeovil, etc. I was once induced to stand as a candidate for the executive of the N.U.T. For many years I have represented the Bath teachers at the annual conferences. Yes, I believe in the aims and aspirations of the N.U.T., and have in my humble way tried to further the objects the Union has in view.'

It may be mentioned that a letter from the Executive of the N.U.T. has just been received by Mr. Prosser for services rendered in connection with the formation of a new Association at Bridgwater.

Mr. Prosser's work among his fellow teachers includes 16 years as secretary of the Pupil Teachers' Examination and Prize Scheme, and it was by his negotiation that the Bath and Wells Diocesan Education Board decided to co-operate. He also largely brought about the establishment of Pupil Teachers' Centre Classes in Bath, of which the School Board has lately assumed the management.

In a measure the abolition of 'payment by results' can be traced to Mr. Prosser, for he prepared the resolution (and moved it at Bristol in 1888) which was adopted afterwards by the various teachers' associations throughout the country.

Bath has helped the benevolent funds of the N.U.T. in a special manner during the past few years—by an annual united schools' concert. This effort has yielded nearly £500. Mr. Prosser has had his share in this good work. He is a Life Governor of the Orphan Fund, and a Life Member of the Benevolent Fund. Latterly, he has devoted much thought to the secondary education problem, and its bearing on the primary school and teacher. He strongly deprecates any barrier being set up between the various grades of schools, and is of opinion that a register of teachers to be worth anything must include the primary teachers. He desires to see a system of education beginning with the primary school, and carried on through technical and secondary schools, as far as the abilities of the children will take them. There should be no greater value set on the work of one set of these schools than on another, and it would tend to their efficient management if they could all be under one managing body. Mr. Prosser has elaborated these views in a series of addresses he has delivered at various places throughout Somersetshire, in his capacity as President of the Somerset Teachers' Federation—a union of teachers that has done much good work in formulating teachers' opinions, placing them before the Somerset County Council and other bodies having control of the educational arrangements in the county. Mr. R. C. Gregory, of Castle Cary, is the energetic secretary of the Federation, and it is to his hard work that Mr. Prosser attributes much of the success which has already attended this young organization.

Before we close this short account of Mr. Prosser, it should be stated than in addition to his other public offices he is a member of the local committee for University Extension, and also of the Church Schools Managers' Union. During our interview with Mr. Prosser we were again and again struck with the very modest estimate he himself places on the part he has been able to take in the educational life of the city and the surrounding neighbourhood. It is ever so. The man who does the most good talks the least about it. We leave Mr. Prosser, wishing him 'God-speed' in his work, and hoping he will yet be spared for many years to carry on the many good works in which he has been so long, honourably, and successfully engaged.

LESSONS FOR CRITICISM CLASSES.

BY C. I. DODD, L.L.A.
Mistress of Method, Day Training Department, The Owens College, Manchester.

LESSON II.

LONGFELLOW'S 'EXCELSIOR.'

SOME explanation is necessary before these lessons are given. Lesson I. was merely introductory. The poem 'Excelsior' is chosen as the central study of a series of lessons, and the first lesson must consist of an analytic preparation.

The content of the child's mind must be analysed, so that the teacher may discover what ideas the child already possesses on the subject. These ideas must be corrected, arranged, and supplemented before we proceed to the presentation of new matter, for before the child can receive new ideas, his old ideas bearing on the subject must be clearly arranged.

In order to work through the whole poem four lessons are necessary.

The material of the four lessons forms a Method Whole, which contains a general truth. In order to arrive at this general truth, we must work through the various stages.

After the general introduction in Lesson I., the matter of the poem is divided into three suitable sections.

Lesson II., verses 1, 2, and 3.
Lesson III., verses 4, 5, and 6.
Lesson IV., verses 7, 8, and 9.

These sections are worked through very gradually and carefully. The developing method is used, that is, the teacher questions the children to bring out their thoughts on the matter, instead of merely stating the narrative himself. During the development of the poem the child learns a great deal incidentally concerning Alpine mountains, glaciers, monks, etc., which are within the scope of the lessons. New ideas are presented very gradually, and are carefully assimilated. The child's self-activity is alert the whole time. He must realise the situation for himself. He is not told what does happen, but he is required to think what is likely to happen. Without attempting to learn the poem by heart, the child does learn it. The events are constantly being presented to the child in a fresh light, and the lesson never becomes monotonous. Continual practice is afforded the children for expressing themselves in language, which is the only natural way of teaching them to express themselves correctly in writing.

When the story has been dealt with, the general truth is arrived at by means of the two stages, Association and Formulation, and finally the general truth is applied to incidents in everyday life.

General Aim.—To encourage thought, correct expression, and literary appreciation.

Apparatus.—Map of Europe. Alpine pictures. Picture of Alpine village, Sword and Trumpet.

Matter.—The first three stanzas of the poem.

Time.—45 or 50 minutes.

Standard.—III. or IV.

Statement of Aim.—We are going to see how a youth passed through an Alpine village.

Questions.—What are we going to do in this lesson?

Require two or three children to state the aim in a complete sentence.

I.—*Preparation.*

1. What do you know of the passes of the Alps?
2. Describe an Alpine village.
3. What is a glacier?
4. What are the dangers in crossing the Alps?
5. What do you mean by 'shades of night?'
   The darkness of evening.
6. What is a banner?
   A flag adorned with a motto.
7. What do you mean by a device?
   A motto.
8. Mention some device you have seen in your home or school.
   'Welcome,' 'A Happy New Year.'
9. Upon what was this device written?
   Upon the banner.
10. What is a falchion?
    A short, broad, curved sword.
    Draw one on blackboard.
    Show a sword in its sheath.
11. What is a clarion?
    A kind of trumpet.
    Draw one on the blackboard.
12. What is an unknown tongue?
    A language that is strange to us.
13. In what language was this motto written?
    In the Latin language.
14. What do you mean by 'spectral glaciers'?
    Glaciers standing white and silent, like spectres.

Summing up.

'Shades of night' = Darkness of evening.
Banner = A flag upon which a motto is written.
Device = A motto.
Falchion = A short, curved sword.
Clarion = A kind of trumpet.
Spectral glaciers = White silent glaciers.

Write these explanations on the blackboard as the pupils give them. Let several pupils give an explanation of a word or phrase, and choose the best to write on the blackboard.

Require the pupils to enter this summing up in their notebooks.

II.—*Presentation.*

Matter.	*Development of Matter.*
(*a*) Teacher reads with correct expression— 'The shades of night were falling fast, As through an Alpine village passed A youth who bore, mid snow and ice, A banner with this strange device, "Excelsior."'	I. 1. Require various children to read this verse. Correct the expression and pronunciation. 2. What does this verse show us? (*a*) Time, evening. (*b*) Place, Alpine village. (*c*) Person, youth. (*d*) What he carried, banner. (*e*) Inscription, 'Excelsior.' Write this summary on the blackboard:—
	II. Who passed through the village? A youth. What did he carry? A banner with a strange device. What was the strange device? The Latin word 'Excelsior.' What does this word mean? Climbing higher.
	III. Mention the rhymes in this stanza? fast passed ice device. Look carefully at the rhymes, and say if you think them good. The first pair have the same sound and are good. The second pair have the same sound, but 'ice' is one syllable and 'device' two syllables, therefore they are not perfect rhymes.
	IV. Express this stanza in prose. As night was coming on, a young man passed through an Alpine village, carrying in his hands a banner, upon which was written 'Excelsior.' Require various children to give a prose version of the stanza, encourage them to express their own thoughts, and not to repeat the words of their neighbour.
(*b*) Teacher reads second stanza— 'His brow was sad: his eye beneath	I. Various children read the same with correct emphasis and expression.

Matter.	*Development of Matter.*
Flashed like a falchion from its sheath, And like a silver clarion rung The accents of that unknown tongue, "Excelsior."'	II. What does this verse show? (*a*) How he looked. (*b*) What his voice was like. (*c*) What he said. Write on blackboard. III. 1. How did he look? He looked sad, but his eye flashed like a falchion. 2. Why is a falchion kept in a sheath? To keep the blade from becoming rusted. 3. Why did his eye flash? Because he was full of ambition to go higher, or he meant to do his duty and go higher. 4. Why was it his duty? Because he carried a motto, and he must be true to it. 5. Why was he sad? Because it was night, and the dangers of snow and glaciers were around him. 6. What was his voice like? Like the sound of a silver clarion. 7. What is the sound of a silver clarion like? It is loud and clear. IV. 1. We have a contrast in this stanza, can anyone explain the word? A constrast means that something is unlike something else. 2. Give an example. Black is a contrast to white.
A contrast: Sad brow, flashing eye.	3. Can anyone point out the contrasts? The sad brow is contrasted with the flashing eye. 4. When do people's eyes flash? When they are pleased, when they feel brave and determined.
Two comparisons. Eye flashed like a falchion. Voice like a silver clarion.	5. We have also two comparisons. What is a comparison? When something is *like* something else. 6. Point out the comparisons. (1) The flashing eye *like* a falchion. (2) The voice like a silver clarion.

Matter.	*Development of Matter.*
	V. 1. Point out the rhymes in this stanza beneath, sheath, rung, tongue. 2. Criticise the rhymes. 'Beneath' has one syllable. 'Sheath' has two syllables, hence they are not perfect rhymes. 'Rung' and 'tongue' have the same sound, but the spelling is different. V. Express this verse in prose. His brow was sad, his eye shone like the blade of a sword drawn from its sheath, and his voice rung out clear as a clarion as he said 'Excelsior.' Cause various children to express the verse in prose.
(*c*) Teacher reads the 3rd verse. 'In happy homes he saw the light Of household fires gleam warm and bright; Above, the spectral glaciers shone, And from his lips escaped a groan, "Excelsior."'	I. Require various children to read this verse, correcting pronunciation and emphasis. II. What does the verse show us? (*a*) What he saw in the homes. (*b*) What he saw beyond. (*c*) His groan. Write on blackboard. III. 1. What did he see in the homes? The light of bright fires. 2. What did he see above him? The glaciers standing like spectres. 3. Where were the glaciers? Higher up the valley. 4. Why did he groan? Because he dreaded to go on amid the snow and ice. 5. Why does he say 'Excelsior'? Because he intends to be faithful to the motto he carries, and to go higher. 6. How does he say 'Excelsior' in the 2nd verse? In loud clear tones. 7. How in the third verse? He groans as though he dreaded to leave the bright fires in the village for the cold mountains. IV. We have a contrast in this verse. Who can point it out?

Matter.	*Development of Matter.*
Contrast: Warm fires. Cold glaciers.	The warmth of the fires is contrasted with the cold silent glaciers.

V. 1. Mention the rhymes in this verse—

light,
bright,
shone,
groan.

2. Criticise the rhymes.

The first pair are good, the second pair are imperfect, because 'shone' and 'groan' have different sounds.

VI. Express the verse in prose.

He saw the fires blazing brightly in the happy homes, while above him the white glaciers stood like spectres, and he groaned.

Cause various children to express this in prose, encouraging originality.

General Recapitulation.

1. What are these three verses about?
   About a young man passing through an Alpine village.
2. What time of day was it?
   It was evening, and night was coming on.
3. Describe the young man.
   He had bright eyes and a sad brow, and he carried a banner, upon which was inscribed 'Excelsior.'
4. Describe the village.
   It was a cheerful village, and bright fires blazed from every hearth, but beyond it was cold and silent, and the glaciers shone like white spectres.
5. Express the whole in prose.
   It was evening in an Alpine village. The fires from the houses gleamed brightly. A young man carrying a banner passed through the village. He was sad and thoughtful, but his eye flashed with resolution, and he said in clear loud tones, 'Excelsior.' His heart failed him as he glanced at the white valley with the gleaming glaciers beyond, but, with a groan, he still said, 'Excelsior.'
6. Require a written composition, to be prepared for the next lesson.

Blackboard Summary.

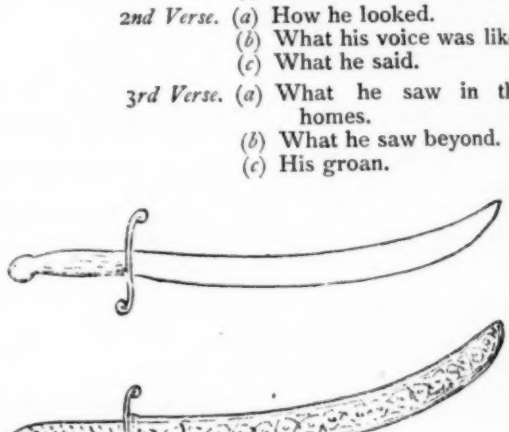
Preparation.

Shades of night = Darkness of evening.
Banner = A flag upon which a motto is inscribed.
Device = A motto.
Falchion = A short, curved sword.
Clarion = A kind of trumpet.
Spectral glaciers = White, silent glaciers.

Presentation.—*1st Verse.* (*a*) Time, evening.
(*b*) Place, alpine village.
(*c*) Person, youth.
(*d*) What he carried, banner.
(*e*) Inscription, 'Excelsior.'

2nd Verse. (*a*) How he looked.
(*b*) What his voice was like.
(*c*) What he said.

3rd Verse. (*a*) What he saw in the homes.
(*b*) What he saw beyond.
(*c*) His groan.



FALCHION.

CLARION.

A QUAINT OLD BOOK ON TEACHING IN THE SEVENTEEN HUNDREDS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),

Author of 'Mental Science and Logic for Teachers.' Late Director of the Birkbeck Training Classes and Lecturer therein on School Method.

In the days of the second George men's minds were not prone to dwell upon the development of their children's faculties; wherefore, in the seventeen hundreds, treatises on school management were to seek. Now and again, however, would arise in the land an Innovator, a rude despiser of use and wont and time-honoured custom. Ignoring the natural apathy as to the right conduct of the understanding, this crank, as his friends doubtlessly considered him, would waste pen and paper, to say nothing of time and energy, in the puerile pursuit of showing men, forsooth! how to cultivate their children's minds.

Such an anomaly was Dr. Jno. Huartes, a Spanish scholar, to whom the treatise now before us is mainly due, as its author has contented himself with translating the Spaniard with an occasional emendation and addition. The aim of the book is thus set out:—'Parents, tutors, and governors of youth may be informed what sort of learning best suits with each genius, and by the due observation (of this treatise) they may be enabled to adapt the studies of their children and pupils in their respective capacities, and thereby lay a just foundation for their future fame and fortune.'

This book of Huartes enjoyed a world-wide reputation. It was translated into Latin and all the modern languages, a statement which, even in these polyglot days, can be made concerning very few products of the Spanish wits, much less those having education as their objective.

Furthermore, we learn that the treatise professed to be 'Founded on the principles of Natural Philosophy,' which means that a wise and laudable attempt was made to correlate the practices recommended with the principles of psychology, as that much despised and more dreaded science was understood in the days between the Fifteen and the Forty-five. If, therefore, the treatise attained to but a mediocre level of excellence, that was more the fault of the times than of the author, who certainly spared no pains to make his efforts excellent according to his lights.

The book is, of course, long since out of print, and would be unavailable but for the protective preservation afforded to it and its fellows by the South Kensington Educational Library authorities, to whom all praise and honour.

The title-page tells us that the treatise was 'Printed for C. Rivington, at the Bible and Crown in St. Paul's Churchyard; J. Osborn, at the Golden Ball in Pater-Noster-Row; and J. Leake, at Bath, MDCCXXXIV.' We purpose laying before our readers a few excerpts from the lore of Dr. Huartes, a comparison of which with present beliefs and customs cannot but prove interesting, and may, in addition, be profitable.

The author opens fire with a learned dissertation on the term *wit*, or rather its Latin equivalent *ingenium*, which by reference to Aristotle, Plato, Cicero, and others of the ancients is defined to be 'a generative power which becomes pregnant but wants a midwife to deliver it,' a statement which not only very forcibly insists upon the necessity for the schoolmaster's existence, but also very aptly describes the direction to be taken by the energies of that functionary.

Another all-important truth finds apt expression on page 4, viz., that 'a strong memory impedes the copiousness of the understanding,' a statement which is so happily expressed by the French, '*beaucoup de memoire peu de jugement.*' Here follows a passage which will clearly show why we use the word humour as equivalent to disposition, and also upon what grounds we speak of a 'dry wit.' 'All the governing faculties in man, the *natural*, the *vital*, the *animal*, and even the *rational*, require each their particular temperament to perform their functions as they ought, without prejudicing or interfering one with another. The natural virtue, as digestive of the food in the stomach, must have a due heat; that which gives appetite, cold; the retentive, dryness; and the expulsive, of what is nauseous or superfluous, a due moisture.'

'Study that which you have to work upon' is a trite saying wherein is to be read the duty of the teacher towards the science of mind. Our author does not lose sight of this, but lays it down as a law of the first importance. 'I shall therefore exhort my readers to study well what sort of wit or ability falls to the share of those whose education may be under their direction, that they may suit their manner of life and study thereto, for 'tis certain that there is no man, how gross and imperfect soever formed, but nature has designed him for something; and he that will make but a despicable figure among the literati, may shine in some parts of mechanicks, or husbandry.'

Nor must it be thought, quotha, that mere book-learning is wisdom. With a directness worthy of Herbert Spencer we are told that 'A learned fool, or meer scholar, is a most contemptible character.' This forcibly reminds us of one of the wise saws dear to Rabelais, viz., *Magis magnos clericos non sunt magnos sapientes:* the greatest clerks are not the wisest men.

Chapter III. opens with a statement the truth of which is as indisputable as it is unwelcome. How often do we find men endeavouring to make their children excel in certain directions dear to themselves, yet obnoxious to the learners, and how frequently do we hear that laziness and lack of industry are the sole causes of the failure! Rather is it true that the pursuit of the uninteresting has engendered these two undesirable traits, which will disappear when the subject shall be changed to one naturally attractive to the child's idiosyncrasy.

Cicero met with this kind of disappointment, as indeed have hundreds of other most worthy yet equally foolish men; therefore we should lay well to heart the truth that 'the child who has neither wit nor ability requisite to the intended science, cannot prove a great proficient, though he have the best masters, many books, and should labour at it all the days of his life.' This, of course, does not mean that incapacity should be assumed before having been proved by attempts to call forth latent ability. So far is this from being our author's contention that he himself cites the case of Cleanthes, who was impelled to excel by the shame of imputed mediocrity.

Another hopeful sign in this sample of the pedagogy of the early seventeen hundreds is the attempt to put forward the best genius of the nation, so that the poor apt scholar should have the advantages of which the rich dullard is incapable of profitably enjoying. Instinct in this is the growing practice of scholarship provision. 'Each science requires a particular and proper genius, which, being diverted from that, is insignificant in any other. Admitting this to be true, as no doubt it is, whoever should at this time of day go into any of our colleges to sound and examine the abilities of the youth there, he would find reason to move many from one science to another, while great numbers of others he would be forced to turn out of doors for dunces, and put others in their places whose narrow fortunes have condemn'd them to some mechanick trade, though by nature better qualified for learning.'

A discussion on the stages in the ripening of the

faculties next engages attention, as well as the cognate question as to which is the proper age for each of the subjects constituting the curriculum; and here again, proper allowances being made, we find our author sagacious and reliable. The motto, 'One thing at a time,' also finds due expression; and Quick's contention that memory, albeit a part of a faculty, is by no means sufficiently important to be regarded as a faculty, much less an all-powerful one, is here insisted upon, for 'The memory is not to be loaded with variety of lessons or studies, but the learner is to be kept to one point till he is master of it.' The truth about development is at least hinted at, if not correctly expressed, in the following statement:—'Wit, like plant, animal, or man, has its several stages—that is to say, its beginning, progression, perfect state, and declension; it springs in childhood, grows up in adolescency, comes to a consistence in the middle age, and declines in old age.' And in connection with this is put forward a hard saying, which would, however, tend in the long run to rid our bookshelves of much useless lumber. No man, we are told, should think of issuing a book until he is at least thirty-three years of age. The poet Milton seems to have been an exaggerated holder of this doctrine, hence his apologies for his beautiful 'Lycidas,' and his postponement of his *chef d'œuvre*, 'Paradise Lost,' until so late a period in his life. The great maxim of Herbert Spencer's pedagogics—viz., 'Follow Nature!'—is emphasised; and Cicero's opinion is used as a clincher of the argument in this direction—'*To strive against Nature, what is it but giant-like to make wars with the gods?*' The sovereignty of Nature, however, does not preclude the necessity for nurture if we would obtain the greatest measure of excellence; wherefore we are aptly told that '*Nature qualifies, art facilitates, but experience gains the mastery.*' Like Shakespeare, the translator of Huartes has his ages of man, they being in the present case, however, done down to five—viz., Infancy, Adolescence, Youth, Manhood, and Old Age. To each of these periods is assigned a certain characteristic mental condition, and here is encountered, in all its fulness of detail, that peculiar system of physiology and psychology which gives the book its quaintness. 'All the differences of wit in man proceed from the three qualities of *heat*, *moisture*, and *dryness*. That is to say, a certain fluid is common to all, but in each individual it has its own characteristic condition upon which the idiosyncrasy of the individual depends; thus, *moisture* is the sign of a *good*, *dryness* that of a *bad* man.' Again, we learn that of the four primordial faculties—viz., memory, sense, imagination, and understanding—imagination proceeds from heat, whilst understanding is dependent upon dryness.

Another question put under discussion by this old-time educationist may be described as heart *versus* brain as the organ of mind. After stating that the Bible settles this query in favour of the heart, in which opinion many worthies acquiese, our author drops in his pebble in favour of the brain, which he gravely proceeds to discuss, laying especial stress upon the four ventricles, in which are, says he, located the springs of all mental activity, there being no differentiation of function with respect to the four presiding genii. To show further the interconnection of soul or mind and body, and how the grossness of the latter is a bar to the excellence of the former, the influence of the stomach and liver is referred to in the following terms. '*Black fumes and vapours arising from the stomach and liver at the time of digestion greatly overcloud the soul*,' which having perused, we can sympathise with our author when he, later on, expresses his fervent thankfulness that the liver and the brain are so far apart. How dismal and direful would have been the unhappy condition of the soul had the liver found its location in the thorax may perhaps be imagined. It certainly baffles and beggars description. Next in order are set out the stages that should be followed in training men for various positions, culminating in a recipe for making good kings. Lest his disciples should rashly imagine that perfection would be within reach of those who followed his directions, we are at once told that perfection and excellence are incapable of attainment, because, alas! that decadence of which we have lately been reminded by Max Nordau was in active career in the time of Huartes; so that our author's principles and practices, albeit that their tendency was to produce perfection, fell short of that high ideal, because of the frailty of our nature. After delivering himself of this pessimistic plaint in a style worthy of Schopenhauer himself, the anonymous translator concludes his labours by promising to deal with the studies proper to each age—a promise which, so far as we have been able to determine, was never fulfilled.

In putting aside the time-stained little book, many thoughts arose in our mind. We could not but remember that Locke had died thirty years before the date given on the title-page of the treatise, and yet no mention whatever is made of the great writer's work on education, but a scheme of mental science is seriously advanced which strikes one as almost antediluvian.

Yet, upon this crude and unworthy science is built up a system which gives forcible expression to many fundamental truths, as, for example, respecting the comparative unimportance of memory—surely an echo of Montaigne's famous '*Savoir par cœur n'est pas savoir*'—his contention that the teacher must study mind, and shape his course in accordance with what he learns from this study; his adherence to Seneca's wise aphorism '*Melius est scire pauca et iis recte uti quam scire multa quorum ignores usum*' (Better to know little and to make use of this, than to know much and be unable to make any use thereof), which indeed might be inscribed as the text upon which the book was written. Furthermore, in insisting upon the necessity for a knowledge of psychology and physiology if teaching is to be thorough, this exponent of pedagogy in the early seventeen hundreds was in advance of many who wrote a century later; insomuch as they merely contented themselves with giving rules of thumb in place of principles and practices founded thereupon. Wherefore we have felt it desirable to introduce Huartes and his anonymous translator to the readers of the 'PRACTICAL TEACHER,' if only because of their belief in the principle voiced later on by Rousseau in his 'Émile,' '*On façonne les plantes par la culture, et les hommes par l'éducation.*'

CLASS TEACHING AND MANAGEMENT.

BY J. GUNN, M.A., D.SC.

Transcription Exercises.

There is an intermediate step between seeing a printed word and writing down such a word. The character we use in writing differs from the printed character. Exercises in transcription are useful, not only in fixing the spelling of words, but in **translating the printed into the written character,** which in young classes forms a real difficulty. Such exercises are necessary to familiarize the pupils with the look of the word in its written form, and for this reason they are preferable to even the simplest form of dictation, in so far as they make no call on the memory, but leave all the mental energies free to be concentrated on the one point aimed at.

Transcription exercises thus naturally form the next step to copying from the blackboard the words written by the teacher for study. They may be used at a very early stage in the pupil's progress, and there is much advantage in continuing such practice to a comparatively advanced stage as well.

It is important that the *first* impression of a word should be a correct one, as it is apt to be enduring. If a child writes a word wrong once or twice, the blunder is very apt to recur. After a wrong mental picture has been formed, this has to be eradicated, which is often very difficult. Hence the importance of careful supervision of the exercises in transcribing words, especially new words. Frequent transcription of common words also serves to make the writing of them easy and finally almost automatic.

Transcription is also an exercise which leads to economy of the teacher's time. This is an important point where he has more than one class to teach, or where he adopts the plan—a plan always productive of good—of dividing a large class into several sections so as to secure more individual effort from the pupils. Although a class is able to write from dictation, that is no reason why they should have no practice in the formation of written words except when the teacher is dictating. In many cases also the passage which is transcribed to-day may profitably be used as the dictation exercise to-morrow, especially with young classes.

Spelling Rules.

With all its irregularities, **our system of spelling does follow certain rules.** No doubt the rules are numerous, and the exceptions to them still more numerous, but the great majority of our words can be arranged into groups for facilitating the systematic teaching of spelling. Much attention is at present being devoted to this matter. It is recognized that words should not be learned merely as they chance to occur in the reading-book, and manuals are coming more into use where words are grouped according to their spelling alone.

This **systematic teaching** should be adopted, for many reasons. Even with the best teaching, essential things are apt to be forgotten by the pupil after they have been learned; and in every subject the teacher must be on the look-out for clues by which a forgotten thing can be recalled to mind. The surest clues for memory are those which depend most on reasoning out from other things, and things are least likely to be forgotten when they have been shown to be connected with other things by clear principles.

You may clearly impress on a pupil that a certain fact is *so;* but if you wish him to have a trustworthy memory of it, tell him not only *that it is* so, but *why it is* so. If this be impossible or inconvenient, show him *other* things that are so likewise; and failing this, show him some things that are exactly *opposite*, for the memory of contrasts is often little weaker than that of resemblances.

By one or more of these clues—*reason why*, *likeness*, and *unlikeness*—a pupil will grope his way back to the spelling of a forgotten word, even when the mental picture on which we chiefly rely has vanished for the time. And these are the three main principles of classification which will guide the teacher in arranging words for systematic study.

For example, in teaching that the past tense of *bar* requires two *r*'s, the teacher may point out as a reason that the second *r* is added to separate the *a* and the *e*, since *a* and *e* with only one letter between give the long sound of *a*. Then, as a contrast to the word and an example of the rule, he quotes *barred;* while as similar words he may give *marred*, *starred*, etc.; or he may pass from the letter *r* and give other pairs of words, like *fated* and *fatted*, *mated* and *matted*, and so on. Of course, if the word be anomalous, no help is got from the use of similarity, but contrast may be available; while as to reason or rule, that may have to be superseded by some historical fact as to how the common rule has come to be departed from in this particular case.

The teacher must, of course, consult a good spelling manual for the actual rules and outstanding anomalies. And it may be added, that for younger classes the spelling manual should be in the hands of the teacher, not the pupils: the classified examples which he gives them on the blackboard, or from their reading-book, will be more impressive, and certainly more intelligible, than a formal rule. With older pupils the case differs considerably, and the rules as well as the examples may be profitably studied by the pupils.

DICTATION.

The Use of Dictation.

How should dictation be taught? The best clue to an answer for a question of this kind is often got by considering first a more fundamental question—

Why should dictation be taught? Dictation is one of the steps usually taken in the process of teaching children to write their mother-tongue, to express their thoughts in written language instead of merely in spoken language. The various steps in that process, according to modern practice, are these: **writing** (that is, penmanship), **spelling, transcription, dictation, grammar,** and **composition.** Original composition is the goal aimed at, and the other exercises are means to that end.

It is an error to regard the dictation exercise, then, as merely a means of testing spelling—a view which is too common in practice. It should rather be said that **spelling is a preparation for the dictation exercise.** The pupil has now reached a stage beyond that of writing single words, and has begun to develop the power of dealing with **phrases.** But these phrases are in the meantime **dictated** to him: the reason for this is that practice in writing down phrases supplied to him is the best preparation for writing down the phrases which by-and-by he will have to make for himself before writing them.

Preparation for the Exercise.

The pupil has now presumably got thoroughly over the difficulty of translating printed into written characters. He has passed the 'letter-by-letter' stage, and even the 'word-by-word' stage of his early transcription exercises. He has now to depend on the mental picture of the words which the sound calls up, and transfer this picture to his slate or paper. This implies that he is able to form a mental picture of all the words dictated to him. How can this ability be secured? Clearly by the **careful study of the passage** to be dictated.

Dictation without previous preparation is useless for teaching purposes, and it is as a teaching process that we have to consider it

here. But unprepared dictation exercises are not merely useless; they are positively hurtful. How is this? It will become clear by considering the process which results in a blunder in this exercise.

A word is dictated which the pupil cannot spell—that is to say, he has no clear mental picture of the word to guide his writing. But he must write something, and he writes down the word wrong. What is the result? He has now obtained from his slate a mental picture of the word in question, but it is a wrong picture. True, the word may be corrected, and the boy may see where he erred; but he has now two conflicting pictures in his mind, the wrong and the right. The teacher must next look for some method of enabling him to distinguish and select the right picture in future whenever the two are suggested by the sound of the word in question. Unfortunately teaching can only attain to **strengthening** the memory of the true; there is no art by which we can ensure **forgetting** the false when once it has been presented to the mind.

The first practical rule then seems to be that **all passages for dictation must be carefully prepared beforehand.** For young classes, the best preparation is that of **transcribing** the passage in full, an exercise which might be performed on the day before the dictation exercise is given. As practice gives increased fluency, a **careful reading** (with silent observation of the spelling) will be sufficient; and at a still more advanced stage attention to the more **difficult and uncommon words** will be all that is needed.

In this exercise it is extremely important to 'hasten slowly.' The young teacher may be oppressed by the prospect that his class may be tested at the annual inspection by being asked to write any part of any lesson in the book, and he may be tempted to require the preparation of the whole of each day's lesson for this purpose. Probably this will defeat his own ends. The whole lesson cannot be prepared thoroughly, and only thorough preparation is of any value. Two or three paragraphs may be as much as he can rely on getting done with absolute accuracy at first; but the power will steadily grow day by day until larger sections can be prescribed. By the time the class comes to a second perusal of the book, the whole lesson is much more familiar, and only the hard words will require special study.

Errors in Dictation.

The most important point in a dictation exercise **is to prevent errors; the next, to correct them.** Teachers do not require to be told that errors will occur, even with careful attention to preparation. But if they know **how** they occur, some hint may be got towards the best means of correcting them. A boy may make an error from various causes.

1. He may have **no clear picture** of the word in his mind, and just writes down 'something.'

2. He may have **a clear but an erroneous picture,** due to faulty observation of the spelling while preparing the passage, and he carefully writes down the word as he learned it, though not as it should have been learned.

3. He may have a clear and correct picture of the word, but may make a **'slip of the pen,'** and write down what he did not mean, without noticing it. This is due to faulty observation of what he is writing, perhaps through fixing his attention on some other part of the phrase.

If the teacher could in each case of error make sure which of these causes has been acting, it would simplify correction; but this is hardly possible. Errors due to the third cause mentioned would require practically no correction; calling the writer's attention to the slip would secure all that is needed. In most cases something more is needed, and the old-fashioned plan of making the pupils refer to their books and **copy out correctly half a dozen times** or more the words misspelt is really a very sound one. But this should **never be regarded as a punishment** for making the blunder; it is really the best means of **fixing in the pupil's mind a correct image of the word,** and the repetition of the word several times is a powerful means of securing permanence in memory.

While errors will occur under any circumstances, their occurrence should always be regarded as exceptional, and not as the general rule. If dictation exercises habitually contain blunders in the majority of a class, there is somewhere a serious fault. Either the class is being asked to do too much, or else they are careless, and the teacher has failed to secure their hearty co-operation. This may indeed be a result of asking them to do what is beyond them. In any case, time is being wasted. The pupils are being familiarized with wrong instead of right pictures of words, and they are further being demoralized by imperfect work being habitually accepted from them.

Revision of Exercises.

It is of course absolutely essential that **every exercise should be seen by the teacher.** This may seem almost a superfluous remark after what has already been said of errors. Yet it is so important that it will bear repetition. This supervision is obviously necessary in order that the teacher may know that the words are correctly written, and also in order that the pupils may give their best attention and care to the exercise. For dictation is one of those exercises which, as has been said, when badly or carelessly done, are really worse than useless.

Classes may be so large that it is difficult and even impossible for the teacher to examine all the exercises. Whenever this happens, **the class is so large that effective teaching is difficult or impossible,** and not in this subject only. The fact remains that the teacher's personal supervision and review of each exercise are indispensable if the best results are to be obtained. At the slate-writing stage of the pupil's progress the passage dictated is usually so short, and the writing should be so clear, that a single glance will serve to discover a misspelling. In more advanced classes, when large, a useful makeshift is to allow the pupils to correct their own, or each their neighbour's exercise. This should be done in *pencil*, after pens are removed, and **only as a preliminary** to the teacher's own examination. It is useful as a means of shortening the time necessary for that examination; but if used as a substitute for it, grave danger of a moral kind may be the result.

How to Dictate.

It is a common fault among young teachers to repeat the phrase dictated several times. Some fall into the habit of unconsciously repeating the words all the time they are being written, half a dozen times or more. This is a mistake. The object is to get the children to **grasp a phrase as a whole, and then write it down.** But they will never put themselves to the trouble of grasping the whole phrase if they can depend on hearing each separate word repeated as soon as they are ready for it. It is also **distracting to the attention,** for they are made to listen in the middle of their writing, which prepares the way for blunders. The teacher is likewise fostering the habit of inattention in his class, by

speaking when they need not attend. The result of this may be that in other lessons also he will have to speak more than once before he secures attention.

In the initiatory stage it may be necessary occasionally to dictate certain words singly; but little groups of two or three words can be written quite easily by very young children who have made good use of their transcription exercises beforehand, and this forms a much higher type of exercise. But for intermediate and senior classes, if the passage has been prepared, so that there are no unknown words, and if the phrases dictated are of a suitable length, there is no good reason why each phrase should be repeated more than once. Exceptions will of course arise, but the best training will be got by adhering to the rule of **dictating each phrase only once.**

Unprepared Dictation.

Unprepared dictation is frequently given as a **test exercise** in examinations, both to senior classes and to young teachers. But this is a totally different use of dictation from that which we have been considering. What we have been discussing is the practice of writing dictated passages as a means of giving **fluency in writing the mother-tongue,** and as a preparation for writing phrases composed by the pupil. But the unprepared dictation exercise is merely a spelling test, or it may be a test of spelling, writing, and punctuation combined. The teacher may find this exercise a useful one for **discovering what his pupils don't know,** but not for teaching them anything new, except indirectly, in so far as it is followed by a study of words that have been misspelt. As a spelling test, it may be made just as difficult as the examiner chooses, by selecting a passage with a sufficient number of uncommon words; and on this account it is a much more trying test than a composition exercise, where a pupil can usually avoid words which he cannot spell, and substitute others more familiar. But except for purposes of examination the unprepared dictation exercise has no serious value.

(*To be continued.*)

ELEMENTARY LESSONS IN AGRICULTURAL ZOOLOGY.

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CHAPTER X.—Insects (*continued*)—Hymenoptera or Membranous-winged Insects.

The *Tenthredinidæ*, or Sawflies, must be reckoned among the farmer's enemies, feeding as they do on his kohl rabi and turnips, his mustard and charlock. It is generally supposed in Norfolk that these insects come from over sea. Towards the end of the last century this county suffered severely from their ravages. A farmer saw them arrive in such thick clouds that they darkened the air. The fishermen, when at a distance from the land, repeatedly saw flights of them pass over their heads, while on the beach and cliffs they were found in such quantities that they might be taken up in shovelfuls. Three miles inland they were described as resembling swarms of bees.

In appearance the form of the Turnip Sawfly (*Athalia Spinarum*) is without elegance, this insect having a thickset body and an abdomen united by a broad base to the thorax. While the mandibles are strong, the remaining mouth parts are less well developed. The saw-shaped ovipositor, or egg-depositing organ, of the female when not actually in use is drawn in, being only protruded during the process of egg-laying. The larvæ of this insect are false caterpillars; *i.e.*, they have from six to eight pairs of pro-legs, instead of the two to five pairs of pro-legs of true caterpillars, and they have a more rounded head than that possessed by caterpillars destined to turn into moths or butterflies. One of their most prominent characteristics is the attitude assumed by them, for especially when frightened they bend the abdomen very much upwards and forwards, and when at rest the hinder part of the body is spirally coiled. There is a great difference in the duration of time during which these insects remain respectively in the larval and pupal stage. While the fully developed larva spins a cocoon in which it remains in the larval condition during the entire winter, it becomes a pupa only two or three weeks before the appearance of the perfect fly.

Though the turnip-fly is not elegantly formed, it is a showy, attractive-looking insect, with a bright orange or reddish-yellow body and black head. The thorax and legs have black markings, and the wings are large. In size the female insect is about a third of an inch long, and the stretch of its wing is large in proportion, being over two-thirds of an inch. The male is rather smaller. During the months of May and August the sluggish insects are found on the crops they attack with their wings folded together. By means of her ovipositor the female saws small holes in the margins or under sides of the leaves, and proceeds to lay her excessively numerous eggs in them. In the course of from four to six days there are hatched almost colourless larvæ, whose skin quickly becomes of a bright green, which changes after the first moult to a dark green or black. The ventral side of the larvæ is of a slate grey, and the head is shining black. Though they are in size only two-thirds of an inch, they have twelve broad body segments, upon which are many wrinkles of the skin. Only one segment besides the head is unfurnished with legs. They undergo four moults, and their presence can be detected by the cast skins, which remain sticking to the leaves even when the larvæ themselves cannot be seen owing to their being rolled up on the under surfaces of the leaves. This pest can also be detected by its way of feeding, for the larvæ keep on the upper or under surfaces of the leaves and eat out longish holes in them. As soon as these have reached a uniform size, other parts of the leaves, or other leaves are attacked. In plants that are badly infested the leaves actually become skeletons, the holes made by the larvæ continually increasing in number till only the framework of the leaf is left. The larvæ are known by the popular names of 'Blacks,' 'Black Palmers,' and 'Niggers.' When mature, they creep into the soil to a depth of from two-fifths to four-fifths of an inch, and spin a small cocoon. The sawfly emerges either the same or the following year. Hence these insects may appear either in May or in August, and are thus enemies both to summer and autumn turnips.

With regard to remedies, hand-picking, though very slow, is one of the most effectual of measures. Fowls and ducks feed greedily on the larvæ, and may with advantage be turned into the fields. Thick sowing and plentiful manuring enable a crop to resist their ravages, and the grubs may be dislodged by sweeping the turnip leaves with twigs of fir, furze, or broom. Strewing with soot is a good application.

The Pear Sawfly (*Tenthredo cerasi*) is of a brilliant black colour tinged with violet. Its larvæ, which are commonly known as slugworms, feed on the leaves of the pear, cherry, plum, hawthorn, and sallow. They have a repulsive appearance, being lumpy in shape, dark of hue, and exuding from their skin a covering of slime, from which they derive their popular name. They have ten pairs of feet, and, in North America, have occasionally been so frequent as to quite strip the cherry, pear, and quince trees of their foliage. The chief remedies to be adopted against these destructive insects are shaking the flies to the ground on boards placed beneath the trees and covered with wet tar, and destroying the slugworms by dusting the foliage attacked with caustic lime, or syringing it with tobacco-water, lime-water, strong soap suds, or a strong solution of hellebore.

The Gooseberry and Currant Sawfly (*Tenthredo grossulariæ*) appears about April, and attaches its eggs in rows to the underside of the leaves by the largest veins. The larvæ are of a bluish-green colour, shagreened with minute black tubercles, which they lose at their last moult. They have a black head, feet, and tail, and, when first hatched, feed in society. When they have consumed the leaf on which they were born, they separate, and eat small round holes in the soft part of other leaves till only the stalk and hard veins are left, and all the fruit for that year is spoiled. Vigorous measures are required to be used against these annoying insects. Wherever the larvæ are prevalent, their attack during the next season should be prevented by completely removing the soil with the cocoons. As soon as the larvæ appear on the bushes, they should either be picked off by hand or destroyed after being shaken on to tarred boards laid beneath the bushes. Syringing with tobacco-water,

alum and water, or lime-water is beneficial, but the most effective remedy, where the bushes are not too badly infested, is to dust flour of sulphur over them while they are still wet with the morning dew.

The Pine Sawfly (*Lophyrus pini*) is another very destructive fly which appears early in summer. The male is black, the female whitish, with black head, breast, and antennæ. The larvæ are brighter in colour, being of a green hue. They cause great damage in pinewoods by feeding on the leaves and the bark of the young shoots. As in the case of the gooseberry and currant sawfly, it is advisable to protect the next year's crop by clearing away cocoons from under infested trees during the winter. Squirrels, woodpeckers, jays, cuckoos, titmice, hedge-sparrows, and swallows are of great service in destroying the perfect flies and cocoons, but the larvæ do not appear to suit them as an article of diet. Several ways of clearing the caterpillars from the trees may be resorted to. Shaking the trees over tarred boards, and isolating uninfected trees by surrounding their trunks with bands of fish oil or soft soap are particularly effective measures. Brushing the larvæ with naphtha, dusting the trees with quicklime, and syringing with a solution of hellebore may also be resorted to.

The Giant Sirex (*Sirex gigas*) is a very beautiful black and yellow fly which does great damage to fir timber, boring, as it does, galleries in the solid wood. When fir trees, attacked by the whitish soft cylindrical larvæ, are cut down, it often happens that they have not attained their full growth at the time the wood has been employed as the joists or planks for flooring, out of which the perfect insects have subsequently emerged. The best method of prevention in the case of this insect is the careful clearing away of trees that have been injured by accident, or ill-treatment, or weakened by disease, and also trees that have been felled or blown down, for this fly lays its eggs in felled as well as in standing timber.

Passing now to the very interesting family of Hymenoptera, known as *Formicidæ*, we find in the ants and termites colonies always of large size, which consist of reproductive and sterile individuals.

In structure they possess large strong mandibles well-adapted for biting, the maxillæ and lower lip not being prolonged like a proboscis. The workers are wingless, while the males and reproductive females have weakly-veined wings. As we should expect, the mesothorax, which bears the larger wings, is most strongly developed in the latter, but the prothorax in the workers. The abdomen is united with the thorax by a one or two-jointed stalk. All the female ants and all the workers possess poison glands, the secretion of which accumulates in a poison-bladder, but the sting is absent in all the *Formicæ*, stingless ants, *e.g.*, the red hood ant (*Formica rufa*), inflicting a wound with their strong mandibles, and then, by bending the abdomen forwards under the thorax, squirting the contents of the poison-bladder into the wound.

During the greater part of the year, only workers' larvæ and pupæ are found in an ants' nest. The eggs, which are so small as hardly to be visible to the naked eye, as soon as they are deposited by the queen ant, who drops them at random during her progress through the nest, are taken charge of by the workers, who immediately seize them and carry them in their mouths, incessantly turning them backwards and forwards with the tongue to moisten them. They then lay them in heaps in the different compartments of their nest, and frequently remove them from one quarter of the nest to another as they require a warmer or cooler, a moister or drier, atmosphere. After a few days legless larvæ are hatched which have feebly developed mouth parts, and are fed by the workers on food broken down for them. Every evening before sunset the workers regularly remove the whole brood, eggs and pupæ, to cells situated lower down in the earth, where they will be safe from cold, moving them again in the morning towards the surface of the nest unless there is a prospect of cold or wet weather. Huber, who has closely observed their habits, says, 'As soon as the sun's first rays begin to shine on the exterior of the nest, the ants that are at the top go below in great haste to rouse their companions, whom they strike with their antennæ, or when they do not seem to comprehend them, drag them with their jaws to the summit, till a swarm of busy labourers fill every passage. These take up the larvæ and pupæ, which they hastily transport to the upper part of their habitation, where they leave them a quarter of an hour, and then carry them into apartments where they are sheltered from the sun's direct rays.' The feeding of the larvæ takes place several times a day, the workers disgorging into their mouths a viscid half-digested fluid. They are kept perfectly white by the workers continually passing their tongues and mandibles over their body.

When full grown, the larvæ of the stingless ants (*Formica*) surround themselves with a silken cocoon, and become pupæ, which under the incorrect name of 'ants' eggs' are collected and used as food for insectivorous birds. In the sting-bearing ants (*Myrmica*) the pupæ are naked. When the pupæ are ready to emerge as perfect insects, three or four workers mount on one cocoon and with their mandibles begin to open it where the head lies. They first pull off a few threads to render the place thinner. They then make several small openings, and proceed very patiently to cut the threads which separate them one by one till there is a hole big enough for the extrication of the prisoner, which they effect with the utmost gentleness. The ant still enveloped in its pellicle is now carefully disengaged from its case, and the wings of such as are furnished with them are carefully expanded. The workers after feeding the newborn insects for several days watch them carefully, following them about and teaching them to find their way amid the labyrinths of the common habitation.

The female ants after pairing let themselves fall to the ground. They then tear off their wings, or this is done for them by the workers, which search them out and take them to the nest, where the laying of eggs quickly begins. M. P. Huber several times witnessed the casting of her wings by the female ant. She was noticed to first stretch her wings with a strong effort so as to bring them before her, then to cross them in all directions, then to reverse them alternately on each side, and at last to make such violent contortions that the four wings fell at the same moment in his presence. Another ant watched by the same observer used her legs to assist in the process.

Termites, or white ants, build commodious cells for the reception of their young, into which the workers convey the eggs of the queen as soon as laid, and where, when they are hatched, they are very carefully fed till they are capable of providing for themselves.

We will now further examine the nests of ants, many of which are conical in shape, resembling hillocks. The nest of the large Red Ant (*Formica rufa*), often found in woods, is exteriorly a conical mount composed of pine needles, pieces of straw, fragments of wood, little stones, leaves, and grain. These ants use for the purpose indeed any portable material in their reach. Within it is much more complex, consisting of numerous cells of various sizes communicating with each other by means of galleries, and arranged in separate stories—some very deep in the earth, others a considerable height above it. To form these, the ants mix the earth excavated from the bottom of the nest with the other materials of which the mount consists, thus giving solidity to the whole. Other galleries, varying in their dimensions, communicate with the outside of the nest at the top of the mound, and are closed at night and on rainy days. These mounds are as big as a small haycock.

The societies of the Small Wood Ants (*Formica fuliginosa*) make their habitations in the trunks of old oaks or willows, gnawing the wood into numberless stories more or less horizontal, the ceilings and floors of which are as thin as a card. Sometimes vertical partitions occur, forming a series of apartments communicating by small apertures. Sometimes light cylindrical pillars take their place, and are arranged in colonnades, leaving a perfectly free communication throughout the whole extent of the story.

The Large Wood Ants (*Formica herculeana* and *Formica ligniperda*, instead of attacking, like the smaller wood ant, decayed tree trunks, eat out passages and cell-like spaces in sound tree trunks.

The nest of *Formica brunnea* is particularly interesting in the complexity of its structure. It is composed wholly of earth, and consists of as many as forty stories, twenty being below the surface of the soil and twenty above, which last, following the slope of the ant hill, are concentric. Each story consists of several rooms, joined by long galleries. The arched roof of the largest rooms are supported either by very thin walls or by pillars and buttresses. While some have only one entrance, viz. from above, others possess a second communicating with the lower story. The main galleries communicate with other subterranean passages, which are often carried to the distance of several feet from the hill. The material of which these insects build their nest is soft ductile clay. Working chiefly after sunset, they take small masses of this substance between their mandibles, and proceed to spread it and mould it with the same organs. They then ensure firmness by pressing the surface slightly with their forefeet, so that when finished the various masses of clay present the appearance of a smooth, well united and consolidated layer. The building of the nest takes place according to a definite system. First they trace the plan of their structure by placing here and there the foundations of the pillars and partition walls. Then, when the walls of the galleries and rooms are raised about half an inch in height, they join them by springing a flattish roof from one side to the other. So assiduous are these ants that they will build a story with its rooms, vaulted roofs, partitions, and galleries in a space of from seven to eight hours. If they begin a story and are unable from want of moisture to complete it, they pull down all the crumbling apartments that are not covered in.

Formica æthiops and *Formica flava*, the Yellow Wood Ant, make use of sawdust in building their dwellings; but while the former uses this substance only for the building of walls and stopping up of

chinks, the latter uses it, in combination with earth and spider's web, to form whole stories.

A species of Sting-bearing Ants (*Myrmica fusca*) may be regarded as insect masons. When they wish to add a fresh story to their nest they begin by covering the top with a thick layer of clay transported from the interior. In this layer they trace out the plan of the new story, first hollowing out little cavities of almost equal depth at different distances from each other, and of a size adapted for their purposes. The ridges of earth left between them serve for bases to the interior walls, which, when they have removed all the loose earth from the floors of the rooms, and reduced the foundations to a fitting thickness, they raise, and finally cover in. So active are these ants that a single worker has been seen to make and cover in a gallery which was two or three inches long, and of which the interior was rendered perfectly concave, without assistance.

Some ants, again, form their nests in the leaves of trees, a species observed by Sir Joseph Banks, in New South Wales, having a nest composed by gluing together several leaves as large as a hand. Thousands of ants unite to keep these leaves in their proper position, and when they are driven away the leaves spring back with great violence. Other ants employ cowdung, the hairs of plants, and down enveloping seeds to help in the formation of their nests.

Let us now briefly examine the social habits and manner of life of these intelligent insects. An interesting account has been given by a naturalist, who has specially observed ant life, of their *danse de l'amour*: 'In the warm days that occur from the end of July to the beginning of September, and sometimes later, the habitations of the various species of ants may be seen to swarm with winged insects, which are the males and females preparing to quit for ever the scene of their nativity and education. Everything is in motion, and the bustle increases till at length the males rise, as it were, by a general impulse, into the air, and the females accompany them. The whole swarm alternately rises and falls with a slow movement to the height of about ten feet, the males flying obliquely with a rapid zig-zag motion, and the females, though they follow the general movement of the column, appearing suspended in the air like balloons, seemingly with no individual motion, and having their heads turned towards the wind. Sometines the swarms of a whole district unite their infinite myriads, and, seen at a distance, produce an effect resembling the flashing of an aurora borealis. Rising with incredible velocity, in distinct columns, they soar above the clouds. Each column looks like a kind of slender network, and has a tremulous undulating motion, which has been observed to be produced by the regular alternate rising and falling. The noise emitted by myriads and myriads of these creatures does not exceed the hum of a single wasp. The slightest zephyr disperses them, and if in their progress they chance to be over your head, if you walk slowly on they will accompany you and regulate their motions by yours. The females continue sailing in the centre of numberless males till the nuptials occur in mid air or on the summit of plants. After the dance is celebrated the males disappear, probably dying or becoming the prey of birds or fish.'

Many of the female ants desert the nests in which they are produced, but the workers provide for the maintenance of the species by forcibly detaining a sufficient number, hanging pertinaciously to their legs to prevent their going out, and never leaving them, though they treat them well, feeding them regularly. A single ant always attends a female and carries off her eggs, of which she lays from four to five thousand during the year. The workers press round her, offer her food, and even carry her about the city. They brush and lick her incessantly.

Among those ants that do not go much from home, *e.g. Formica flava*, sentinels selected from the working ants are stationed at the avenues of their nests. An observer, who once disturbed the little heaps of earth thrown up at the entrances into the nest of the Yellow Ant, saw a single ant come out three several times as if to inquire what was the matter. A knowledge of the presence of danger has also been shown by *Formica herculanea*, the Greater Wood Ant. When those working ants that were at the greatest distance from the rest were disturbed, they ran towards them, and striking their head against them communicated their fear, till the whole colony was in a ferment, those neuters which were within the tree running out in crowds to join their companions in defending their nest.

Ants impart their ideas to each other sometimes by running from one to another in a semi-circle, and striking with their head or jaws the trunk or abdomen of the ant to which they mean to give information. Their antennæ are the principal instruments of their speech. When the military ants go on their expeditions, before setting off they touch each other on the trunk with their antennæ and forehead, which is immediately taken as the signal for marching. When a hungry ant wants to be fed, it touches with its antennæ, moving them very rapidly, those of the individual from which it expects its meal.

Ants, too, are patriotic. M. Latreille once cut off the antennæ of an ant. Its companions at once anointed the wounded part with a drop of transparent fluid from its mouth. When a burden is too heavy for one ant, another will come to its aid, and if one is threatened with an attack, all hasten to the spot to join in repelling it. They seem also to recognise one another after a considerable period of absence. Some ants originally belonging to the same nest were separated for four months, and on being brought together saluted mutually with their antennæ, and united once more to form a family.

No insects show greater anger when disturbed than ants. With the two strong mandibles, which arm their mouth, they fix themselves so obstinately to the object of their attack, that they will sooner be torn limb from limb than let go their hold, and after their battles the head of a vanquished foe may often be seen suspended to the antennæ or legs of the victor. Their abdomen is also furnished with a poison bag, in which is secreted the venomous fluid known as formic acid. Standing erect on their hind legs, when their enemy is out of reach, they send from their anus with considerable force a shower of poison exhaling a strong sulphurous odour, sufficient to repel any insect or animal. Nor are they afraid of man. If you point your finger towards any Hill Ant, *Formica rufa*, instead of running away it instantly faces about, straightens its legs, raises its body, and opens its jaws to bite. Their wars generally occur between nests of different species, occasionally between those of the same species. The wars of ants not of the same species take place usually between those differing in size, and the smaller often come off victors through the force of numbers. 'When the great attack the small they seek to take them by surprise (probably to avoid their fastening themselves to their legs), and seizing upon them by the upper part of their body they strangle them with their mandibles; but when the small have time to foresee the attack, they give notice to their companions, who rush in crowds to their succour. Sometimes, however, after suffering a signal defeat, the smaller species are obliged to shift their quarters, and to seek an establishment more out of the way of danger. In order to cover their march many small bodies are then posted at a little distance from the nest. As soon as the large ants approach the camp the foremost sentinels instantly fly at them with the greatest rage; a violent struggle ensues; multitudes of their friends come to their assistance; and, though no match for their enemies singly, by dint of numbers they prevail, and the giant is either slain or led captive to the hostile camp.'

Two species of ants, *Formica sanguinea* and *Polyergus rufescens*, may be regarded as slave-making species, but they do not make slaves of adults, carrying off only the larvæ and pupæ. These they educate in their own nests till they arrive at their perfect state, when they undertake all the business of the society, it being physically impossible for the rufescent ants, on account of the form of their jaws and the accessory parts of their mouth, either to prepare habitations for their family, to procure food, or to feed them. The slave ants build or repair the common dwelling, make excursions to collect food, attend on the females, feed them and the larvæ, and sun daily the eggs, larvæ, and pupæ. In addition, they feed their masters and carry them about the nest. So idle are the latter, that when shut up in captivity together with food they made very little effort to provide for their larvæ, and soon die themselves of hunger. When one slave ant was introduced under these circumstances, it made a cell in the earth, collected the larvæ and placed them in it, assisted the pupæ that were ready to be developed, and preserved the life of the master ants still remaining. The sanguine ants are not quite so supine as the rufescent. They assist their slaves in the construction of the nest, collect the fluid of the aphides, which forms the chief food of ants, lie in wait for a small species of ant on which they feed, and when their nest is menaced by an enemy carry their slaves down to the lowest apartments.

The food of ants is partly of an animal, partly of a vegetable, character, but it largely consists of insects and small animals. They mostly devour caterpillars, with a variety of dead or wounded beetles, *e.g.*, cockchafers, mammals, birds, and reptiles. Those species that live in woods may therefore be regarded as the farmer's friends, for, as we shall see, a great many caterpillars form an extreme danger to his crops. Ants are very fond of all sweet substances, and their invasion into houses is due to this cause.

Ants are especially fond, however, of licking up the sweet juice, or honey dew, which aphides, one of the farmer's worst foes, excrete from their abdomens. On plants invested with aphides many ants are found, which greedily suck up all the limpid drops hanging from the abdomens of the aphides. They even promote the shedding of the juice by these 'milch kine,' by patting the abdomens of the aphides on each side alternately with their antennæ, moving them very briskly. Some species of ants carry the aphides to the plant parts on which they thrive best, and again, when these are sucked dry, transport them to other uninjured parts. So far as they do this,

they must be considered enemies of the farmer and horticulturist. Sometimes aphides are kept in the overground or subterranean nests of the ants. Examples of the latter case are afforded by the common yellow meadow ants, who shelter the aphides underground, where they live on the roots of grasses and other plants. When it is necessary to get fresh food for them, they enlarge the nests, so that new plant roots are left bare, and carry the aphides to them. 'Ants make a property of these aphides, for the possession of which they contend with great earnestness, and use every means to keep them to themselves. Sometimes they seem to claim a right to the aphides that inhabit the branches of a tree or the stalks of a plant; and if stranger ants attempt to share their treasure with them, they endeavour to drive them away, and may be seen running about in a great bustle, and exhibiting every symptom of inquietude and anger. Sometimes to rescue them from their rivals they take their aphides in their mouth. They generally keep guard around them, and when the branch is conveniently situated, they have recourse to an expedient still more effectual to keep off interlopers—they inclose it in a tube of earth, and thus confine them in a kind of paddock near their nest, and often communicating with it.'

In England ants generally emerge from their subterranean winter quarters on a fine day in March, and continue their labours till the middle or latter end of October, first devoting themselves to the repairing of the injuries which their nest has received during their period of inactivity, all the upper stories of their dwellings being frequently levelled by the winter rains and snow. Their labours are not confined to the day, the Red Ant (*Myrmica rubra*), the Mason Ant, the Negro Ant (*Formica fusca*), and the Yellow Ant (*Formica flava*), having frequently been observed to work at night, though in less numbers than during the day.

Ants may be considered as the best insect constructors of roads. The Jet Ant, *Formica fuliginosa*, makes several main track ways with smaller paths branching off from them, extending sometimes as far as forty feet from its nests, and leading to those spots in which the workers collect their provisions. They always travel on these roads, from which they carefully remove bits of stick and straw and other impediments of their progress, keeping low the herbs and grass by continually biting them off. The roads of the Hill Ants (*Formica rufa*) are sometimes a hundred feet in length and several inches wide. These ants are especially fond of basking in the sun, and Huber, one of their most interested and constant observers, thinks them very fond of sport. 'I approached one day,' he says, 'one of their formicaries, exposed to the sun and sheltered from the north. The ants were heaped together in great numbers, and seemed to enjoy the temperature which they experienced at the surface of the nest. None of them were working. This multitude of accumulated insects exhibited the appearance of a boiling fluid, upon which at first the eye could scarce fix itself without difficulty. But when I set myself to follow each ant separately, I saw them approach each other, moving their antennæ with astonishing rapidity; with their fore feet they patted lightly the cheeks of other ants. After these first gestures, which resembled caresses, they reared upon their hind legs by pairs, they wrestled together, they seized one another by a mandible, by a leg, or by the antennæ, they then let go their hold to renew the attack, they fixed themselves to each other's trunk or abdomen, they embraced, they turned each other over or lifted each other up by turns—they soon quitted the ants they had seized, and endeavoured to catch others. I have seen some who engaged in these exercises with such eagerness as to pursue successively several workers, and the combat did not terminate till the least animated, having thrown his antagonist, accomplished his escape by concealing himself in some gallery.'

We have seen that ants are honey-loving insects. Since it is very undesirable that they should invade the flowers of such plants as balsams, in which they could, from their construction, readily get at the honey without touching the pollen, and would, by their presence, drive away pollinating insects, the stipules or leaf-like organs, at the base of the leaves are modified into glands secreting honey. Drops of honey are thus provided for them at the base of every foliage leaf, which is in no respect inferior to that of the flowers in quality, while it surpasses it in quantity. As it is nearer and more accessible the ants readily suck it up, and are content to travel no further. In the tropics another process in which these insects are concerned takes place. There are several plants, *e.g.*, the Banksian Rose, and several species of Acacia, whose foliage is protected against the attacks of leaf-eating insects by their means. The plants afford certain small and very fierce ants lodging in special cavities, and nourish them with their albuminous and saccharine secretions. The ants on their part, as soon as they detect a foe, by biting and squirting the formic acid, with which they are armed, frighten the offender away. Some species of lettuce protect themselves from the attacks of ants by the secretion of latex, which readily escapes from their brittle tissues, and coagulates on the surface into a sticky mass. As soon as the ants reach the scales which surround the flower-heads of these plants which abound in latex, they rupture the walls of the latex tubes with the claws of their feet, and the milk exudes in minute drops. Their feet and abdomens are smeared with latex, and the more they struggle, the stickier they become. Some manage to escape and fall to the ground, others are glued in the coagulating latex, where their dead bodies may be seen clustered round the flower-head. Ants on the whole must, indeed, be considered as undesirable floral visitors, but there are several Composite plants which employ a whole garrison of ants to defend themselves against the ravages of beetles which bite great holes in their flower-heads. The flower-heads secrete honey whilst still in the closed stage, which is greedily consumed by the ants. They fiercely resent the onset of attacking beetles, and repel them by the emission of formic acid. As soon as the florets on the flower-heads begin to open, the secretion of honey diminishes till it ceases; beetles no longer come to devour them, and the ants wander to younger flower-heads in search of honey.

Ants form an important agent in the dispersion of seeds. All through the summer the ant *Tetramorium cæspitum* drags seeds to its ant hill, and stores them up there. Other species, *Lasius niger*, *Formica rufibarbis*, &c., which live in holes in the earth, hollow trees, &c., convey to their holes seeds with smooth external coats, but leave both coats and their contents untouched, feeding on the mantle-like *caruncle* which invests the seed. 'Only thus can we interpret the fact that the seeds dragged by ants under the ground or into crevices in walls germinate in these situations in the following year. It sometimes happens also that here and there a seed is left behind on the route by the ants, and in that case the caruncle is usually eaten off. Such abandoned seeds likewise germinate in the following year, and this explains the fact that the routes traversed by ants are regularly planted with certain species of plants. For example, in the Botanic Gardens at Vienna, the presence of the greater celandine, *Chelidonium majus*, is a constant feature of the ant runs.'

From the point of view of the agriculturist and lover of forestry it must be admitted that ants do a great deal of damage. Several species, as we have seen, injure crops by excavating the soil in meadows and cornfields, killing the plants, and rendering harvesting difficult. Others destroy tree stems. Ants are indirectly harmful in the encouragement they give to aphides, a bad agricultural and horticultural pest. They also attack the floors of summer houses and dwelling houses, though it is only in tropical countries that their ravages in this direction become serious.

With regard to remedies, where ants have got into a room, the first step to be taken is to discover their nest, and destroy the insects gathered together in it with paraffin or boiling water. If it proves to be too difficult to find and destroy the nest, all the openings by which ants can enter must be stopped up with a mixture of lime and extract of colocynth. Field and garden ant nests may often be destroyed by quickly digging them up, pouring paraffin over them, and then igniting it. Another effectual plan is to frequently tread or roll down the ant hills which are thrown up. It must be admitted that all these methods of destruction seem cruel when the industry, pertinacity, and sagacity of these insects in building their homes is borne in mind.

(*To be continued.*)

NOTES ON 'LA GRAMMAIRE.'

BY W. T. THOMPSON, B.A. (LOND.).

(*First Class French Honours.*)

By the kindness of the proprietor of the English publishing rights of this charming little comedy, we are enabled to publish additional notes on this work, which, as our readers will be aware, is prescribed for the CERTIFICATE EXAMINATION THIS YEAR. Our object in publishing these notes is to render it easier for the large number of our readers who are entering for this examination, and who have few opportunities of securing adequate tuition in French, to pass a creditable examination in the subject.

The numbers quoted refer to the lines and pages of M. G. PETILLEAU'S excellent edition, which is published by HACHETTE & Co., 18, King William Street, Charing Cross (paper, 9d.; cloth, 1s.).

Our readers will find, we believe, that the notes given in this edition, together with the notes we are publishing, will supply them with the maximum of the assistance needed for studying this work.

SCENE 1.

1.20.—*lui échappe des mains*, lit. escapes to him from the hands, slips from his hands.

1.20.—*se casse*, lit. breaks itself, *i.e.* breaks. To express the intransitive use of a transitive verb, the French use the reflexive form.

1.22.—*Sacrebleu*, hang it! confound it! *Sacrebleu* = *sacre Dieu*, as *corbleu* = *corps* (*de*) *Dieu*, and *morbleu* = *mort* (*de*) *Dieu*.

1.23.—*toi!* The disjunctive pronoun is here used for emphasis. See 2.26.

2.1.—*Vous m'avez fait peur*, lit. you have made fear to me, you have frightened me. *Avoir peur* = to be afraid. *Faire peur* (*à quelqu'un*) = to make some one afraid.

2.3.—*va*. The nom. is *M. Caboussat*. The predicate comes first because the sentence commences with the relative pronoun *que* in the accusative case.

2.8.—*près de*, near. But *de près* is an adverbial phrase, meaning 'near at hand.' Do not confound *près* with *prés*, the pl. of *pré*, meadow, or the adj. *prêt*, ready.

2.8.—*abricotier*, apricot-tree. With *abricot*, *abricotier* compare *pomme*, *pommier*; *poire*, *poirier*.

2.9.—*propre*, adj. tidy. *Propre* also means one's own, very; as, *sa propre fille*, his own daughter, *ses propres paroles*, his very words.

2.18.—*pour y mettre des fraises*, to put some strawberries in it. The infinitive, when it denotes a purpose, is preceded by *pour*. The indirect cases of the 3rd personal pronoun referring to inanimate objects are *y* (in it, at it) and *en* (of it, from it).

2.20.—*Il doit être resté*, it must have been left behind.

2.21.—*salle à manger*, dining-room. A second noun or, as here, a gerundial infinitive, is joined to a noun by *à* to express the use to which the first noun is put, or the power from which it derives motion, as, *fer à cheval*, horse shoe; *tasse à thé*, tea-cup; *moulin à vent*, wind-mill.

2.24.—*On ne casse pourtant rien*, Yet nothing is broken. Notice how the French avoid using the passive, using instead of it, as here, the indefinite pronoun *on*, or a reflexive verb. *Rien*, from the Latin *rem*, a thing, something. Its sense being thus properly affirmative explains why it is necessary to use *ne* with it.

SCENE 2.

2.26.—*de l'aplomb*, assurance. *Aplomb* is from *à* and *plomb* (lead), lit. in a plumb line, perpendicularly. Hence figuratively for 'impertinent assurance.'

2.27.—*Dame* for *notre dame*, an invocation to the Virgin; afterwards a mere exclamation.

2.27.—*si elle savait*, if she only knew.

3.9.—*il fait si chaud depuis un mois*, it has been so hot for the last month. The present tense with *depuis* indicates that an action or state commenced in a past time is still continuing. *Avoir chaud* = to be hot (of a person); *faire chaud*, used impersonally, = to be hot (of the temperature).

3.17.—*soit*, subjunctive, because depending on the interrogative *croyez-vous?*

3.17.—*renommé*, re-elected. But *renommé*, as an adjective, = renowned, and *renommée* (noun) = renown.

3.19.—*à son intention*, to his success. The phrase contains a somewhat profane allusion to the custom of holding religious services for a particular purpose.

3.24.—*Chatfinet*, lit. 'Sly puss,' from adj. *finet*, sly.

3.24.—*ancien*, adj. old, in the sense of 'former.'

3.27.—*en*, thence, *i.e.* from Paris.

3.29.—*distribués*, the past part. is masc. pl., because it agrees with the dir. obj. *les* (= *ballons*), which precedes it.

3.35.—*que ce père Machut!* *Que* is expletive here, and cannot therefore be translated.

4.1.—*de Chatfinet*, any 'Chatfinet.' *De* after a negative = 'any.'

4.2.—*fait venir*, brings, lit. makes come, *i.e.*, causes to come.

4.5.—*Ce qu'il nous faut, c'est . . .* what we want is . . . *C'* (*c'est*) cannot be translated into English.

4.9.—*à la main*, in his hand. Parts of the body take in French the definite article, not, as in English, the possessive pronoun.

SCENE 3.

Lecture, reading (L. *lectura*). But 'a lecture' is in French *une conférence*, or *un discours*, and a 'lecturer' is *un conférencier*.

4.27 and 8.—*toi*, *vous*. Notice that Machut addresses M. Caboussat in the second plural pronoun *vous*, whilst he himself is addressed as *tu* and *toi*. The second singular pronoun is used in French by masters addressing servants, superiors addressing inferiors, and very near relatives addressing each other. To use it to a person who should be addressed as *vous* would be to insult him.

5.4.—*Ça avale*, they swallow. *Ça* is a familiar contraction for *cela*.

5.5.—*J'en ai connu une*, I have known one (of them).

5.6.—*à laver*, for washing. See 2.21.

5.8.—*Ce que c'est que notre pauvre humanité*, how frail is our poor humanity.

5.23.—*Où ça?* how far?

5.28.—*est occupée—depuis*, has been filled—for. See 3.9.

5.32.—*il y a assez longtemps qu'il est là*, he has been there long enough.

6.5.—*bien des choses*, many things. *Bien* as an adverb of quantity requires not only *de*, but the definite article.

6.5.—*pays*, here used in the restricted sense of native place, district.

6.21.—*la tribune*, the raised platform from which a French *député* addresses the House. The French custom differs from the custom of the English Houses of Parliament, where a member speaks from his place.

7.1.—*À moi*. *À moi* is the dative of the disjunctive pronoun, rendered necessary because it represents and is a repetition of the person indicated by *vous* in *qui vous en veut* (6.33.), where *vous* is dative.

7.11.—*vous êtes passé devant*, you passed by (them). From its position it would seem that *devant* governs *dix fois*; but this is not so. It may either be regarded as an adverb, or as a preposition with the word to which it relates understood.

7.22.—*en voisin*, as a neighbour, in a neighbouring manner.

7.29.—*chapeau neuf*, new hat, *i.e.* new-made hat. Distinguish between *un nouveau chapeau*, a new hat, *i.e.* another hat, and *un chapeau neuf*, a new hat, *i.e.* new-made hat.

SCENE 4.

8.9.—*met*, pres. 3rd s. of *mettre*, puts on.

8.18.—*il vient de sortir*, he has just gone out. *Venir de* with an infinitive = to have just.

8.19.—*rentrer*, corresponds to the familiar English expression 'be back.'

9.6.—*Ça ne te regarde pas*, that does not matter to you.

9.10.—*elle est venue*, she came. Notice that *venir* forms its compound tenses with *être*, and that the past part. consequently agrees in number and gender with the subject.

9.14.—*Qu'est-ce que c'est que ça*, what is that? *Qu'est-ce que c'est?* = what is it? The *que* which follows is expletive, and *ça* is in apposition with *ce*.

9.23.—*labours*, ploughs. *Labourer* is to plough, or till, and *laboureur*, a ploughman, or husbandman generally. Compare the Biblical phrase '*labourers* in the vineyard.'

9.33.—*constaté*, proved, verified.

10.5.—*Qu'est-ce que c'est que cet homme-là?* What is that man? See 9.14.

'COMPOSITION AND MORAL TRAINING.'

A SERIES OF LESSONS PREPARED ON A NEW PLAN FOR THE UPPER STANDARDS.

BY B. ELDERKIN,
Model School, Westminster College.

☞ THE LESSONS FULLY MEET THE LATEST INSTRUCTIONS IN THE NEW CODE, 1896.

INTRODUCTORY NOTICE.

THE author of these lessons, which are to appear month by month in the PRACTICAL TEACHER, is indebted for the general idea to suggestions derived from the educational works of John Ruskin and others—viz., that much of what is most essential for boys and girls to learn may be successfully taught through *Biography*.

The plan of combining this with the special subject of *Composition* is the author's own, and he claims for it among others the following advantages :—

1. It provides suitable themes such as children will delight to write upon.
2. Much time and labour is saved to the teacher.
3. No new duty is added to the already crowded curriculum.
4. Teachers will be much aided in that part of their duty which the Code puts upon them of taking "reasonable care to bring up the scholars in the habits of virtue, &c."
5. As the "mind grows by what it feeds on," and in no mental exercise are the thoughts made so completely one's own as in the effort of production and reproduction, it seems to be eminently fitting that Composition and Moral Training should be thus closely associated.

The plan has been already tried with success in the author's own school, and it may not be out of place to give a few hints gained by experience.

a. The subject matter may be *read* over by the teacher or even by one of the scholars, or, better still, the teacher may previously read it and give the substance to the class in his own words. He may thus at discretion introduce other illustrations or omit some of those given.

b. The blackboard summary may be put before the class if the teacher is short of time, or, what is much better, a similar one may be made up while the teacher questions the class on what has been told them.

c. The whole of the subject should be put before the class at the first lesson, but it will often happen that there will be sufficient matter for two or more written exercises.

d. It is not intended that these lessons should be used exclusively, but that they should form a part of every month's Composition work.

e. Keep the best exercises, and allow the Inspector to see the plan upon which they have been worked, as well as the topics written upon.

The following is the first of the series, and will be followed by others of a similar character.

LESSON I.—THE ADVANTAGES OF EDUCATION.

1. Boys and girls are frequently heard to say in reference to their education as a whole, or to some branch of study in particular, 'What is the use of it all?' or, 'What good will this do me?'

2. It has been a common mistake to undervalue education, on the ground that so many eminent men and women have risen to the very front rank of their professions who started in life with little or no education to help them.

3. A very little inspection, however, will show that not only did not such persons rise without the help of education, but, on the contrary, that the want of education was the greatest hindrance to their progress. Their ultimate success was due to the determined way in which they struggled for knowledge long after the school age is supposed to be past. They had to climb the steep path of self-education, and would have given all they possessed to have had such chances of learning as are now the common heritage of every British boy.

4. Hugh Miller, the greatest Scotch geologist of his day, and the editor of a Scotch newspaper, was a stonemason. His work in the quarry set his mind in the direction of scientific study of rocks and plants, and he devoted his evenings to reading and the practice of Composition.

5. John Bunyan, who lived to write the most popular book in the world, next to the Bible, learned to read after he was married, from two or three books which were all the worldly goods his newly married wife brought to him.

6. Who has not heard of Dr. Livingstone, the great African missionary and traveller? At the age of ten he was sent to work in a factory, having had scarcely any schooling; but his first savings were spent in the purchase of a Latin grammar, which he mastered along with a large amount of general reading by sitting up at night after his twelve hours' work in the mill. When Livingstone conceived the ambition of being a missionary, the great difficulty was how to obtain the necessary medical degree. He set himself to work on such studies as he could master by himself, practised the strictest economy while work at the factory was plentiful, and then, out of the savings of the summer months, paid for his attendance at college classes in the winter.

7. Elihu Burritt, who became a most brilliant scholar, is said to have mastered every important European language before he was thirty years of age. A rich man, who saw in him great promise as a boy, offered to pay the expense of his education at the university, but he refused, preferring to work at his trade as a blacksmith, and continue his education in his own way. Every moment that could be spared from forge or anvil was given to his books, one of which he always carried about with him, in hat or pocket, in order that no precious moment should be lost.

8. Michael Faraday, the great scientist, was the son of a poor blacksmith. He was apprenticed to a bookbinder in London at the age of thirteen. He not only assisted in binding the books, but he made himself master of their contents, often staying behind to read the precious volumes after his fellow workmen had gone home.

9. Sir Richard Arkwright, who invented the spinning machine, and thus laid the foundation of Britain's manufacturing greatness, had to acquire the rudiments of learning after attaining to manhood, and even after fifty years of age he devoted two hours a day to such studies as are now easily mastered by a sixth or seventh standard boy.

10. So far, then, from thinking of such men as making their way without education, let us rather remember that the greatest obstacle to their success was their want of education.

11. It would be wrong to prophesy success for every well-educated boy or girl who leaves school, for other qualities of character are required besides education; but of the disadvantages of entering upon life without a good education as a foundation there can be no question whatever.

12. Let us try to understand and remember these three simple truths :—

(*a*) That the golden age of opportunity is *youth*.
(*b*) That education is of use to us, just as we *prize* it and pursue it for its own sake.
(*c*) That a sound education was never more needed in the battle of life than it is to-day.

Blackboard Summary.

1. Common mistakes about education.
2. Struggles of those who started without it.
3. Hugh Miller : stonemason, geologist, and writer.
4. John Bunyan : tinker and author.
5. Livingstone : weaver, student, medical missionary.
6. Elihu Burritt : blacksmith and linguist; offer of university training.
7. Sir R. Arkwright : spinner and scholar at fifty.
8. What such examples teach us about our own educational advantages.

NOTES AND NOTIONS.

BY T. B. ELLERY,
President of the National Union of Teachers.

Personal. The Editor having been good enough to ask me to supply him with Notes and Notions affecting the educational questions of the day, it will be my pleasure and privilege month by month to address myself to the readers of the PRACTICAL TEACHER on matters which, I trust, will be of interest to all.

It will be my endeavour, in the observations I make, to hold the balance fairly between parties, and in any criticism which I may feel compelled to offer, to say nothing which will unnecessarily wound or offend.

Let me add one other word. From the very nature of things, I must, in dealing with the work of the N.U.T., refer to my friends and colleagues with whom I have been associated for many years, and sometimes, perhaps, to my own work.

I trust, however, my readers will understand the position, and give me credit for good intentions.

With this understanding at the outset we start fairly, and I have only to say, that I shall at all times be glad to hear from my readers, for whose views I shall endeavour to find room, whenever possible.

The New President. I do not know who should be the more heartily congratulated, the members of the Union, in having secured the services of so able a man as the coming President, or Mr. Macnamara himself.

It may seem somewhat out of place that one who has worked with Mr. Macnamara for some years at the Executive board, and who is at the present moment a brother officer, should 'sound the loud timbrel' in his praise. One is open to the charge of partisanship. But common justice demands that his merits should be recognised in these 'Notes,' and I am proud to be able to say, and I say it in all sincerity, that Mr. Macnamara has fully earned his position, and deserves all the honour which has been conferred upon him. His zeal, his great ability, his fearless championship of the teacher's cause, his power in debate, his ready and brilliant pen, are well known; but they are more especially known, perhaps, to those of us who have had the pleasure of working with him year after year. Young as he is, his experience has been as varied as that of many men ten or even twenty years his senior.

A pupil teacher in a Devonshire school, a student at Boro' Road College, an assistant master in Yorkshire, a head master in Bristol, a contributor to the London and provincial press, the writer of 'Notes and Notions' in this journal for a considerable period, and of many articles in *The Schoolmaster* and *Teachers' Aid*, a member of the Executive of the N.U.T., Editor of the *Schoolmaster*, Vice-President of the Union, and now its President! Such, in brief, is the history of this exceptionally gifted man, whom the teachers of England and Wales have delighted to honour.

The future, I trust, has other honours in store for him. I have crossed swords with him on many occasions; in the years gone by we have probably voted in opposite 'lobbies' more frequently than in one and the same 'lobby'; we differ widely in politics; but one cannot fail to admire his zeal, his earnestness, his great ability, and his determination to do the right thing. He fought a plucky—but of course, from the first a hopeless—battle in Deptford at the last General Election, and it is certain that his services will be again in demand at the proper time. I might even go the length of saying I think I could name one or two possible constituencies, but—all in good time!

Mr. Macnamara may rely not only on the support of the members of Conference during Easter week, but on the assistance and loyal co-operation of his colleagues at Russell Square in the year which lies before him.

MR. T. J. MACNAMARA,
The New President of the N.U.T.

The N.U.T. in 1895. Membership and Finance. The Report of the Executive to Conference shews progress all along the line. Starting the year with a membership of 27,625, the Union to-day numbers within its folds 32,690; there are 13 District Unions, and 424 Local Associations. In five years the increase in membership has been over 16,500, or at the rate of over three thousand a year. And, if we look at the Balance Sheet, we shall find an increase in investments and balance at the bank, such as one would naturally expect to find from the extraordinary roll of membership. The Legal Assistance Fund has investments amounting to over £4,000 and a balance at the London and County Bank of over £1,600, the Parliamentary Fund has investments amounting to nearly £2,000 and a balance at the bank of over £2,500, and the General Fund has £250 invested and a balance at the bank of over £1,800. There was, therefore, at the date when the Chartered Accountant examined the books, a total of over £6,000 invested, and there was also a total of over £6,000 at the bank.

Conference will surely be satisfied with such a financial statement as this. If not, it will be very hard to please.

The Union's Progress. Probably the feature of the past year was the election to Parliament of the two teacher candidates, Mr. Yoxall for West Nottingham, who recaptured the seat for the Liberal Party, and Mr. Ernest Gray for North-West Ham, who re-captured the seat for the Conservative Party. It is not a little remarkable that each of the Union candidates won a victory for the party to which he belongs, and there is certainly reason for hearty congratulation that one sits on one side of the House, and the other on the other side.

Teachers are so sharply divided in politics that any other arrangement would probably cause grave dissatisfaction. Be that as it may, Messrs. Gray and Yoxall had not long been in the House before they gave evidence of their ability, and of their desire to bring about necessary reforms. The Education Estimates gave them their opportunity, and that they used it well is now almost ancient history. Only a few weeks ago Mr. Yoxall again rendered excellent service in the House by stating the grievances of teachers certificated before 1862, and at the same time he put the Union's case for a general superannuation scheme for teachers, Sir John Gorst's answer to both points being entirely satisfactory.

The notable victory won by the Executive in the matter of 'Suitable Occupations' is one upon which the whole Union may well be congratulated, and though the deputation to Sir John Donnelly on the question of Drawing was not apparently so successful as it was on the occasion of the interview with Sir John Gorst, yet much good was done by the ventilation of the subject, and there is some reason for supposing that certain changes will be made. One cannot read the Report of the Royal Commission on Secondary Education without being convinced that Mr. Yoxall's presence among the 'trusty and well-beloved' was of the greatest possible value. It is true that the Commission's proposals in the matter of the constitution of local authorities are not in line with those suggested by the N.U.T., but generally the policy of the two bodies is strikingly similar—another tribute to Mr. Yoxall's great ability, resource, and tact.

The election of Mr. Gray as member for North-West Ham made it necessary for the Executive to take him out of school and to place him in charge of one or more departments of the Union's work at 71, Russell Square.

After careful consideration it was decided to hand over the management of the Education and Parliamentary Committees to his care, just as the Law Department is in the hands of Mr. T. A. Organ, B.A., barrister-at-law, and the Finance and General Purposes Committee in the hands of Mr. James. There can be no doubt that this is exactly the work for which Mr. Gray is suited. Given health and strength, it is certain he will make his mark in that department, and thus amply justify his appointment.

The Law Work of the Union. There is probably no branch of the Union's work so well-known as that of the Law Committee, with Mr. Addiscott as the able and zealous chairman, and Mr. Organ as the legal adviser. Not only does the Committee afford protection to its members in ordinary assault cases, in claims for salary, &c., &c., but it takes up cases of wrongful dismissal, holding public meetings, and supporting financially, when necessary, those who have been unjustly called upon to give up their posts.

The Aycliffe dismissal is a case in point, and is an illustration of the power of the Union. Here the teacher was dismissed, most unjustly as everybody knows. But he has now returned to his old post, and there is a body of Managers absolutely in his favour. The Fingringhoe case is still more recent. There the teacher, Mr. With, was called upon to resign, really because he would not occupy a particular house, though he had done excellent work, and had saved the School from extinction, inasmuch as it was under a 'warning' from the Education Department when he took charge of it.

As a result of the indignation meeting held, and of Mr. Gray's question in the House, the notice of dismissal has been withdrawn!

What an object lesson does this afford to the few men, but comparatively large body of women who still hold aloof from the N.U.T.! When will these people learn that membership provides an 'Insurance against Accident' of a real and effective character?

In subsequent 'Notes' I hope to deal more fully with the work of the Law Committee, contenting myself at present with a short reference to one of the most serious matters which the Union has ever had in hand.

The Portsmouth Difficulty. My readers have probably read some particulars of the recent serious crisis at Portsmouth. The facts lie in a nutshell. There was a difficulty as to salary, there was another as to corporal punishment, and there was a foolish regulation which required all teachers to be at School at 7.55 in the morning. It was reported that Her Majesty's Inspector sided with the Board on the 7.55 question, and took it upon himself to lecture those who had been guilty of a breach of the rule. If the report be correct it remains to be seen to what extent this action of H.M.I. will be approved by the Education Department. Matters became so serious at last that the Executive of the N.U.T. gave certain advice, with the result that the Portsmouth Board found itself in difficulties. Public opinion and the local press were with the teachers, and, finally, a conference between the Board and a deputation from the young people concerned was arranged.

As I write, the final agreement is not before me, but it may reasonably be hoped that wise counsels will prevail, and that a compromise, honourable and satisfactory to both parties, may be arrived at.

Mr. Organ has conducted the case with his usual skill and judgment, but it must not be forgotten that Mr. Clancy, who is on the spot, has rendered most valuable service throughout the proceedings. It goes without saying that it has been a very anxious time for all concerned.

The Brighton Conference. A few days after the publication of the issue of the PRACTICAL TEACHER in which these lines appear, the N.U.T. will be in Conference assembled. Everything points to a gloriously successful week. On the Monday there will be a reception by the local authorities, the clergy, and others interested in education, after which the retiring President will duly install Mr. Macnamara as the President for the coming year. The address concluded, certain formal business will be done, and then the first Session of Conference will be over. In the evening the Annual Meetings of the Orphanage and Orphan Fund, the Benevolent Fund, and the Provident Society will be held, at all of which most gratifying reports will be presented.

Manchester last year dispensed with the Public Dinner, but Brighton intends making this function one of the features of the week.

There will also be a Ball and Soirée in the Dome and Royal Pavilion, on the Wednesday, the Committee responsible for the arrangements being exceptionally fortunate in having the whole of the magnificent suite of rooms placed at its disposal.

On Thursday T.R.H. the Duke and Duchess of York will honour Brighton and the Teachers' 'Purse Day' ceremonies with their presence. This I suppose, will be THE feature of the week's proceedings. Brighton has decided that a right royal welcome shall be given to the Duke and Duchess, and in this welcome the Union will very properly take an important part.

Teachers generally throughout the country will appreciate the compliment which this royal patronage of their charitable

work means, and I will answer for it that no more hearty cheers have ever been heard than those which will greet the Duke and Duchess when they step upon the platform on that Thursday afternoon. This Orphan and Benevolent work is dear to the hearts of thousands of teachers, and the encouragement and support which this royal visit will give to those who are labouring in a truly noble cause can scarcely be overestimated. I venture to say that not only will the teachers assembled never forget the day, but the Duke and Duchess themselves—no matter how many other happy days may be in store for them—will never forget it. The grateful tears of the widow and the orphan, the 'God bless you' of thousands of throats, will be the reward, and I am confident it will be an all-sufficient reward!

But I must not trust my pen to linger over this delightful ceremony. Many of my readers will be there to take part in it, and to assist in making it a great and glorious success.

The Educational Work of the Conference. In all probability the new Education Bill, if its provisions are known at Easter, will occupy the attention of Conference during the whole of one of its sessions, unless those provisions meet with the approval of the Union's leaders, in which case the discussion will be curtailed, and other business reached. But the whole question of further financial aid for Voluntary Schools is surrounded with so much difficulty, so much party feeling has been imported into the discussion, that we must be prepared not only for long debates in the House, but also for a 'speech-day' at the Conference, and for much anxious consideration and discussion when the members of the new Executive assemble at Russell Square.

Should the Bill be laid on the table before Easter the present Executive will meet, in London if possible, but if not in London, then in Brighton, before Conference assembles, in order to frame resolutions to be submitted to the representatives on Easter-Tuesday morning.

The following by the usually well-informed London correspondent of the *Manchester Guardian* has been extensively copied, and may be of interest :—

'A very confident rumour has been circulated to-night of fresh Ministerial dissensions over the Education Bill. I fancy that the report is, at all events, a little belated, because there is good reason to believe that the measure has not been under consideration during the last two or three weeks. At the same time it is certain that while the main lines of the Bill have been settled, some details are still outstanding, and so many different interests are affected that there may easily be difficulties until the final draft has been dealt with. This will have to be done shortly, as it is now more probable than ever that the Bill will be introduced before Easter—most likely just on the eve of the adjournment,—so that its provisions may be considered during the holidays. It is not a very long or complex measure, but its provisions are by no means so unimportant as they have been rumoured to be in some quarters, though they may fall short of the expectations of some of the supporters of the Church.'

Conference Arrangements. The following Official Programme has reached me just as we go to Press. I give it in full so that my readers who will be in Brighton during Easter-week may be able to make their arrangements in good time :—

Saturday.—Reception, Banqueting Room, Pavilion, 10 a.m. to 10 p.m.

Easter Sunday.—Special service, St. Peter's Church, 9 a.m.

,, Monday.—Reception, Banqueting Room, 9 a.m. to 5 p.m.
1st Session of Conference, Dome, 2 p.m.
Annual Meeting Provident, South Drawing Room, 5 p.m.
Annual Meeting Benevolent, Music Room, 7 p.m.
,, Orphan and Orphanage, Music Room, 8 p.m.
Meeting, and Tea for Class Teachers, Banqueting Room, by Invitation of the Brighton Class Teachers, 6 p.m.
Meeting of Rural Teachers, North Drawing Room, 7 p.m.
Meeting of Ladies, South Drawing Room, 7.30 p.m.
Meeting of Voluntary Teachers (N. A. V. T.), 7 p.m., at Christ Church Schools (Refreshments), by Invitation of the Managers.

Tuesday.—Temperance Breakfast, Banqueting Room, 8 a.m.
2nd Session Conference, 10 a.m.
3rd ,, ,, Private Session, 2 p.m.
Dinner, Banqueting Room, 7 p.m.

Wednesday.—4th Session Conference, 9.30 a.m.
5th ,, ,, 2 p.m.
Soirée and Ball, Royal Pavilion and Dome, 7.30 p.m.

Thursday.—6th and last Session Conference, 9.30 a.m.
Votes of thanks at 12 o'clock.
Presentation of Purses, Dome, to T.R.H. the Duke and Duchess of York, 3 p.m.
Mayor's Reception, Pavilion, 7 to 10 p.m.

Friday.—Excursions—Hastings, Arundel, and Chichester.
Symposium not settled, probably Telemachus Room, 'Old Ship' Hotel.
Arrangements are being made for the re-unions not to interfere with the other Conference functions.

RECENT INSPECTION UNDER ART. 84B.

SIX MONTHS' WORK HAD BEEN DONE.

A Surprise Visit.

The Inspectors arrived at 9.30, and at once inspected the registers, which, by the time-table, were due to be closed at 9.20. Then began the business of examination.

The Head Inspector commenced work with the Upper Classes (VI. and VII.), examining the work-book minutely, both with regard to the quantity of work done and to its equal distribution over the several periods allotted. Taking the arithmetic as stated therein, he selected the following four sums from work done, and, dividing the whole class (VI. and VII. together) into four divisions, A, B, C, D, gave each boy *one* to work—the first sum being given to Standard VII. Boys *only*:—

(A) What income would be derived from an investment of £100 in a 5 per cent. stock at £120?
Ans. £4 3s. 4d.

(B) $3\frac{1}{4} - 4\frac{5}{16} + 5\frac{1}{2} - 2\frac{11}{16}$.
Ans. $1\frac{3}{8}$.

(C) Express $1\frac{1}{4}$ hours as the decimal of 1 hour, and 1 hour as the decimal of $1\frac{1}{4}$ hours.
Ans. 1·25 and ·8.

(D) How many slates, each 1 yard long and $\frac{1}{2}$ yard wide, would be required to cover a field ten acres in area?
Ans. 96,800 slates.

While the boys were busy with these, the teacher was asked what work had been done in repetition. The 'Ode to the Skylark,' by Shelley, was the piece prepared, and children were taken at random to repeat verses. Special attention was paid to clearness of articulation and distinctness of utterance. The boys—in a large room—were told to speak out that boys in another class about ten yards away could repeat and spell words spoken by the reciters.

Boys who expressed a desire to do so were next allowed to recite verses, and then the Inspector proceeded to test their appreciation of certain passages. As a rule, nothing was asked other than meanings and allusions such as might reasonably be required from boys reading the same piece. The answers given, however, were much criticised, as in many cases the children—giving the substance of the answer required—failed to put it in the form necessary to satisfy the question. One boy, in answer to the question 'Where is the blue deep?' replied 'The sky,' instead of giving the words 'In the sky.'

The arithmetic, having been worked, was then examined and the result noted. The Inspector commented upon the method employed in working the second question, and asked what boys had started by adding $4\frac{5}{16}$ to $2\frac{11}{16} = 7$.

The teacher was then asked to work the last sum upon the blackboard for the class, and then to show the manner in which it should be set down by them.

Before leaving, the Inspector placed upon the blackboard 10d. ÷ 2, and asked for answer, then 10d. ÷ 2d., and, requiring the answer in each case, Nos. 1 to 100 — Nos. 1 to 99.

(V.) *Arithmetic* :—

(1) Find cost of 200 articles at 19s. 11d. each?
Ans. £199 3s. 4d.

(2) Find the cost of 2 tons 3 cwt. 28 lbs. at 11s. 8d. per ton.
Ans. £1 5s. $2\frac{3}{4}$d.

(3) How much of a pudding is left after eating one half, one tenth, and two sevenths? Ans. $\frac{4}{70}$ of the pudding.

(4) If a field contains 10 acres, and three men can mow a quarter of it in a day, how long will it take six men to do the rest? Ans. $1\frac{1}{2}$ days.

After the sums had been marked and the questions as to method answered, the teacher was requested to explain and work the last sum.

Geography was next taken. France was one of the countries set down in the work-book for study, and the Inspector questioned the children very closely as to the physical features, the products, exports, and towns. While doing so the teacher drew a sketch map upon the blackboard. This the Inspector proceeded to fill in with the assistance of the children.

Reading.—While the children were working the problems in arithmetic, the Inspector went round with the *Daily Chronicle*, calling upon boys at hazard to read selections therefrom. These 'pars' were in connection with the Zeitoun massacres, and were certainly rather difficult.

The main points required were :—
1st. That the boys should read slowly.
2nd. That the words should be carefully phrased in order to render the meaning of the writer in the best and most striking manner.

In the lower classes no regular questions, or examination, were given, the Inspector merely passing round while the teachers proceeded with the ordinary morning's work.

Standard IV. was engaged in a reading lesson, and the Inspector listened while the teacher called upon two or three boys to read portions from parts of their books that had already been prepared.

In Standard II. the teacher was giving a lesson in Elementary Science. The subject for the morning's work was the bee, and, in addition to a good wall diagram, specimens of wax, honey, and honeycomb were available. The Inspector pointed out, however, that these specimens lost much of their value with being fastened to a card; each child ought to have been able to handle and examine the article closely.

The books in these classes were very carefully looked over, the Inspector complimenting the teachers upon the careful way in which they had been supervised.

MENTAL ARITHMETIC FOR THE STANDARDS.

BY T. B. ELLERY, F.R.G.S.,
President of the National Union of Teachers.

'*Mental work will strengthen the power of computation, and facilitate the handling of simple problems.*'—MR. CODD, H.M.I.S.

Tenth Paper.

STANDARD VII. (PART I.)

Scheme A.—Averages, percentages, and stocks.

Scheme B.—Vulgar and decimal fractions, averages and percentages, investment of savings, consols.

It is, of course, important that our scholars should leave school able to solve readily any little arithmetical problem, and to make small, everyday calculations without reference to pen or pencil—in a word, and in the right sense of the word, it is important they should be 'smart.' I have known boys able to work fairly difficult exercises in stocks, square and cube root, etc., when given in an examination paper, but quite unable to work mentally, in a reasonable time, such a little thing as 13 articles at 1s. $3\frac{1}{2}$d. each. They do not see that 13 is 1 dozen + 1, that $15\frac{1}{2}$d. each is 15s. 6d. a dozen, and that the answer is therefore 15s. 6d. + 1s. $3\frac{1}{2}$d. = 16s. $9\frac{1}{2}$d. Such exercises as 5378 × 25, or 1359 × 125, or What is my gain % if I sell an article for 14s. at a gain of eighteenpence? would at once drive them to paper and pencil!

Unfortunately, this state of affairs is more common than many people imagine, even in schools where mental arithmetic is by no means neglected. The object of this series of Papers has been to encourage dexterity in handling problems, which, though they may appear difficult at first sight, become comparatively easy when a little thought is brought to bear upon them.

Simple Rules worth Remembering.

1. To calculate the cost of a dozen.—Reckon each penny as a shilling, and each farthing as 3d.

2. To multiply by 25.—25 is $\frac{1}{4}$ of 100. Multiply by 100, therefore, and divide result by 4.

3. To multiply by 125.—125 is $\frac{1}{8}$ of 1,000. Multiply by 1,000, therefore, and divide result by 8.

4. To find simple interest for 1 year at $2\frac{1}{2}$%, $3\frac{1}{3}$%, etc.—$2\frac{1}{2}$% = $\frac{1}{40}$; $3\frac{1}{3}$% = $\frac{1}{30}$; $6\frac{1}{4}$% = $\frac{1}{16}$; $12\frac{1}{2}$% = $\frac{1}{8}$.
This applies also to profit and loss exercises. Thus I buy an article for 18s., and sell it at a gain of $33\frac{1}{3}$%. Find selling price.—$33\frac{1}{3}$% = $\frac{1}{3}$; $\frac{1}{3}$ of 18s. = 6s.; 18s. + 6s. = 24s. selling price. And so on.

5. To divide by 25.—Multiply by 4 and divide by 100.

6. To divide by 125.—Multiply by 8 and divide by 1,000.

7. 59 at $8\frac{1}{2}$d. each?—Take 5 dozen at 8s. 6d. and deduct $8\frac{1}{2}$d.
85 at $11\frac{1}{4}$d. each?—Take 7 dozen at 11s. 3d. and add $11\frac{1}{4}$d. And so on.

8. Let the following be well known and understood:—
Profit and loss on a transaction of, say, £990—
To find (*a*) *Prime cost*—
1. Gain of, say, 10% ; 110 : 990 : : 100 : *x*.
2. Loss „ „ ; 90 : 990 : : 100 : *x*.
To find (*b*) *Selling price*—
1. Gain of, say, 10% ; 100 : 990 : : 110 : *x*.
2. Loss „ „ ; 100 : 990 : : 90 : *x*.

The course at this stage should include exercises in vulgar and decimal fractions, averages, percentages, profit and loss, stocks, proportion, square and cube root, mensuration, and simple exercises such as:—A and B can do a piece of work in 6 days which A alone can do in 8 days. How long would B alone take?

We might also include simple tests in discount, proportional parts, etc.

A.—*Vulgar and Decimal Fractions.*

1. Find value of $\frac{2}{5}$ of £2 + $\frac{1}{8}$ of 4s. [16s. 6d.]
2. Find value of $\frac{3}{5} + 1\frac{1}{5} + \frac{3}{10}$. [$2\frac{1}{10}$.]
3. Simplify $\frac{1 - \frac{1}{4}}{\frac{1}{2}}$. [$1\frac{1}{2}$.]
4. Simplify $\frac{\frac{1}{8} \text{ of } 16}{\frac{1}{5} \text{ of } 2}$. [5.]
5. What must you add to $\frac{2}{3}$ of 9 to make $\frac{1}{4}$ of 60? [9.]

6. Reduce $\frac{1}{3}$ of a guinea to the fraction of $\frac{1}{8}$ of £4. [$\frac{7}{10}$.]

7. Reduce $\frac{2}{5}$ of 5 crowns to the fraction of $1\frac{1}{2}$ of a sovereign. [$\frac{1}{3}$.]

8. $\frac{1}{2}$ of $\frac{2}{3} \div \frac{3}{5}$ of 18? [$\frac{1}{3}\frac{5}{6}$.]

9. Take $\frac{1}{4}$ of $\frac{1}{3}$ of £3 from $\frac{1}{5}$ of £2. [3s.]

10. What fraction of $\frac{1}{4}$ of 2 tons is $\frac{1}{6}$ of a ton? [$\frac{1}{4}$.]

11. Add 3·5, 2·75, and 3·25. [9·5.]

12. Take 13·085 from 20. [6·915.]

13. Multiply 1·5 by ·25. [·375.]

14. Divide 16 by ·75. [$21\frac{1}{3}$.]

15. What is the difference between ·6 and ·$\dot{6}$? [$\frac{1}{15}$, or ·0$\dot{6}$.]

16. Find the value of ·375 of £1. [7s. 6d.]

17. Add ·35 of £1 to ·75 of 10s. [14s. 6d.]

18. Find the value of ·45 of £1 − ·5 of half-a-crown? [7s. 9d.]

19. Bring ·3 of 10s. to the decimal of $\frac{1}{4}$ of £2. [·3.]

20. Bring ·25 of 1 cwt. to the decimal of ·5 of 200 lb. [·28.]

B.—*Averages and Percentages.*

1. Find the average of 4, 5, 6, 7, 8. [6.]

2. Find the average of 30, 40, 12, 2. [21.]

3. Find the average of ·5, ·2, ·3, ·6. [·4.]

4. Find the average of 6d., 8d., 1s. 4d., 2s. 6d. [1s. 3d.]

5. Find the average of £1 10s., £2 10s., £6 10s., £1 10s. [£3.]

6. The average of 4 numbers is 8. The average of 3 of them is 9. What is the fourth number? [5.]

7. The average of 5 numbers is 10. The sum of the first, second, and third is 26, and the fourth is the same as the fifth. Find the fifth number. [12.]

8. The average of three numbers is 24. The first is 30, and the second is double the third. Find the 2nd and 3rd numbers. [14 and 28.]

9. In an examination 4 boys have 4 sums right each, and 2 others have 2 sums right each. Find the average number of correct answers per boy. [$3\frac{1}{3}$.]

10. I bought 16 articles, and the average cost was half-a-crown. 4 of the articles cost 5s. each. What did each of the others cost on the average? [1s. 8d.]

11. What per cent. is 4 of 8? 5 of 35? 9 of 90? 8 of 48? [50%; $14\frac{2}{7}$%; 10%; $16\frac{2}{3}$%.]

12. What per cent. is 7 of 21? 3 of 15? $12\frac{1}{2}$ of 50? 16 of 72? [$33\frac{1}{3}$%; 20%; 25%; $22\frac{2}{9}$%.]

13. A man receives $2\frac{1}{2}$ per cent. commission on all debts collected. He collects £60. Find his commission. [£1 10s.]

14. A man receives $3\frac{1}{3}$ per cent. commission on all debts collected, and this commission amounts to £4. Find the amount of debts collected. [£120.]

15. A boy had 60 marbles. He lost 8 and gave away 12. What per cent. of the original number remained? [$66\frac{2}{3}$%.]

16. In a certain examination there were 75 candidates. 6 of these failed. What per cent. passed? [92%.]

17. In a certain class of 56 boys $12\frac{1}{2}$% failed to pass in reading. How many passed? [49.]

18. What sum must a man pay to insure a ship and cargo worth £8,500 at $2\frac{1}{2}$%? [£212 10s.]

19. What sum will produce £30, simple interest, in $2\frac{1}{2}$ years at 3% p.a.? [£400.]

20. In what time will £400 amount to £480 at 5% p. a., s. i.? [4 years.]

C.—*Profit and Loss.*

1. I buy a hat for 10s. and sell it for 12s. Find gain %. [20%.]

2. I buy a piano for £30 and sell it for £40. Find gain %. [$33\frac{1}{3}$%.]

3. A man bought a knife for 8d. and sold it for 6d. Find loss %. [25%.]

4. I buy milk at 1s. 4d. a gallon and sell at 5d. a quart. Find gain %. [25%.]

5. I sell a horse for £55, gaining 10%. Find cost price. [£50.]

6. A farmer bought a cow for £20 and sold it at a gain of $12\frac{1}{2}$%. Find selling price. [£22 10s.]

7. A gentleman bought a house for £500, and on selling it again lost 20%. Find selling price. [£400.]

8. I sell a horse for £17, losing 15%. Find cost price. [£20.]

9. A man sold a horse for £40, losing 20%. What should he have charged in order to gain 10%? [£55.]

10. A farmer sold a cow for £19, losing 5%. What should he have charged in order to gain 5%? [£21.]

11. A man bought coal at 15s. a ton and sold it at a shilling per cwt. Find his gain %. [$33\frac{1}{3}$%.]

12. A man bought coal at 16s. a ton. At what price per cwt. must he sell it to gain 25%? [1s.]

13. A coal merchant sold 5 cwt. of coal for 6s. If he himself paid 18s. a ton, find his gain %. [$33\frac{1}{3}$%.]

14. I sold an article for 16s., gaining 4 shillings. Find gain %. [$33\frac{1}{3}$%.]

15. I sold an article for 12s. 6d., gaining 5 shillings. Find gain %. [$66\frac{2}{3}$%.]

16. A man sold an article for 12s., losing 3s. Find loss %. [20%.]

17. A clock was sold for £2 10s. at a loss of four half-crowns. Find loss %. [$16\frac{2}{3}$%.]

18. A man bought apples at 2 for a penny and sold them 4 for threepence. Find gain %. [50%.]

19. I bought 40 apples at 10 a penny and sold them at 4 a penny. Find my gain %. [150%.]

20. I bought 2s. worth of pears and sold them at 3d. each, gaining 50%. How many did I receive for the two shillings? [12 pears.]

D.—*Stocks.*

1. What is my income from £2,000 2½ per cent. stock at 96? [£50.]

2. What is my income from £3,600 3% stock at 98½? [£108.]

3. What is my income from £1,200 2¼% stock at 91½? [£27.]

4. I invest £1,920 in the 3 per cents. at 96. Find my income. [£60.]

5. I invest £440 in the 2½ per cents. at 88. Find my income. [£12 10s.]

6. I invest £360 in the 2¾ per cents. at 90. Find my income. [£11.]

7. I invest £480 in the 3 per cents. at 95⅞. Find my income, brokerage being ⅛. [£15.]

8. How much 2½ per cent. stock at 92 can I buy with £460? [£500.]

9. How much 2¾ per cent. stock at 95 can I buy with £380? [£400.]

10. If I sell out £800 2½ per cent. stock at 96, what shall I receive? [£768.]

11. I sell out £1,000 from the 3 per cents. at 94½. What shall I receive? [£945.]

12. I sell out £1,500 from the 2½ per cents. at 90¼. What shall I receive? (Brokerage ¼.) [£1,350.]

13. How much 2½ per cent. stock at 94⅞ can I buy with £760? (Brokerage ¼.) [£800.]

14. How much 3¼ per cent. stock at 104⅞ can I buy with £630? (Brokerage ¼.) [£600.]

15. How much 2½ per cent. stock at 89⅞ can I buy with £720? (Brokerage ¼.) [£800.]

16. I invest in the 3 per cents. at 90. What per cent. do I receive for my money? [3⅓%.]

17. I invest in the 3 per cents. and receive 4% for my money. Find price of stock. [75.]

18. I invest in the 5 per cents. and receive 4% for my money. Find price of stock. [125.]

19. What sum must I invest in the 2½ per cents. at 80 to secure an income of £100? [£3,200.]

20. What amount of 3½ per cent. stock at 85½ must I hold in order that my income may be £35? [£1,000.]

21. What sum must I invest in the 3 per cents. at 85⅜ to obtain an income of £60? (Brokerage ¼.) [£1,710.]

[The next and concluding Paper will deal with Mensuration, Decimal Coinage, and the Metric System. There will also be a miscellaneous section.]

CIRCULAR TO TRAINING COLLEGES.

Circular 377.

CERTIFICATE EXAMINATION. PROPOSED ALTERATION IN FORM OF CLASS LIST.

Education Department,
Whitehall, London, S.W.,
21st February 1896.

SIR,

Considerable difficulty has been experienced by the Department in the classification of students (especially second year students) who take an approved University Examination, or are examined upon a programme of studies outside the ordinary curriculum.

The difficulty, of course, arises in respect of the literary and not of the technical part of the examination.

The studies of the students referred to are often highly specialised; and it is found to be practically impossible, by any system of marking, to co-ordinate satisfactorily the results of examination in the large variety of subjects which are taken, and to bring them exactly into line with the standard adopted by the Department for students who take the ordinary certificate examination.

My Lords propose, therefore, in future to issue two Class Lists, one relating to the technical examination (Part I. of the Syllabus) and the other to the remainder of the examination (Part II.).

The Department will be solely responsible for the classification on the technical examination (Part I.), and for the classification in Part II. of all Candidates who take the ordinary certificate examination.

The College classification will be accepted for all students who take special or University Examinations.

The questions which will have to be decided on the double classification are :—

(1.) Which Candidates will be held to have passed the Examination?

(2.) Which Candidates have passed sufficiently well to be qualified to superintend Pupil Teachers?

It is proposed that as a rule—

(*a*) all who obtain a place in both Lists shall be held to have passed;

(*b*) all who obtain a First or Second Class in both Lists, or who obtain a First or Second Class in Part I., and pass an approved University Examination, shall be qualified to superintend Pupil Teachers.

The only qualification to these rules will be that all students taking College Papers in place of Part II. will be required, as they have hitherto been, to pass in the General Paper, the results of which will also be looked to in deciding whether these Candidates are qualified to superintend Pupil Teachers.

My Lords hope that this classification, besides being very much better than that hitherto adopted for Day Colleges, will be the means of calling greater attention to the all-important professional subjects of Part I., which in some cases have suffered from the eagerness of students to devote themselves mainly to subjects of University rank.

They would be glad to receive the opinion of the authorities of your College on this proposal.

I have the honour to be, Sir,
Your obedient servant,
G. W. KEKEWICH.

To————————
————————Training College.

CIRCULAR TO LOCAL AUTHORITIES.

EVIDENCE OF AGE UNDER REVISED REGULATIONS AS TO CERTIFICATES OF AGE, PROFICIENCY, AND SCHOOL ATTENDANCE.

Education Department,
Whitehall,
London, S.W.,
2nd March 1896.

SIR,

In accordance with the Regulations for the Duties of Registrars of Births and Deaths made under the Births and Deaths Registration Act, 1874, a certificate of the registry of a child's birth may be granted by the Registrar at the time of registration on one of the forms furnished by the Registrar-General for the purpose, on payment of a fee not exceeding threepence.

Doubts having been expressed whether the above certificate is a Registrar's Certificate which may be accepted by the Local Authority as evidence of age for the purpose of the issue of a Labour Certificate (*Revised Regulations of the Education Department as to Certificates of Age, Proficiency, and School Attendance, dated 7th June 1894, Schedule III.*), my Lords are advised that such Certificate of the registry of birth should, when presented, be accepted by the Local Authority as evidence of age satisfying the requirements of the Revised Regulations.

I have the honour to be, Sir,
Your obedient Servant,
G. W. KEKEWICH.

To the Clerk of the School Board
or School Attendance Committee.

CIRCULAR TO H.M. INSPECTORS.

SUITABLE OCCUPATIONS.

EDUCATION DEPARTMENT, WHITEHALL,
LONDON, S.W.
17th March, 1896.

SIR,—

(1.) KINDERGARTEN Occupations have for some time been used in our infant schools, and Manual Instruction has also been given to the elder boys in many schools for older children, while the elder girls have similarly been taught Cookery and Laundry Work; but the scholars in the first, second, and third standards have, as a rule, had hitherto no Manual Training, except in so far as it has been supplied in the forms of Needlework and Drawing. Manual Instruction is a valuable part of school training, and my Lords desire to encourage Managers of Public Elementary Schools to introduce, where circumstances permit, a suitable course of Manual Occupations for the three lowest standards.

Kindergarten Occupations as used in the infant school are not suitable for the children in schools for older scholars. The Mat-weaving, Stick-laying, Embroidery, Tablet-laying, and Building with Bricks or Cubes, which serve to give young children ideas of Form and Number, as well as to train hand and eye, seem trivial to the ordinary child of nine or ten years of age. On the other hand, few of the common workman's tools can with safety be put into the hands of children under the age of eleven.

(2.) An Occupation ought to satisfy several conditions :—

(*a.*) It must be educative, and should especially stimulate independent effort and inventiveness. Any work that provides a real training for hand and eye is in a true sense educative, but the most valuable work of all is that which imparts a knowledge of form, colour, and the properties of materials, at the same time that it fosters manual dexterity.

(*b.*) It should admit of being dealt with in a progressive course.

(*c.*) It must be attractive to the children, and afford a welcome relief to other studies.

(*d*) It must not involve the use of needlessly expensive materials.

(*e*) It must be capable of being practised in an ordinary schoolroom, without risk of harm to children or damage to furniture.

(*f*) It must, in cases where the classes are as large as the Code permits, be so simple that it does not require an undue amount of individual attention. Large classes should, where possible, be subdivided for these Occupations.

(*g*) It should avoid a long series of preparatory exercises apart from finished results, and the finished article should be one that is attractive to a child. At the same time, the construction of articles for sale is undesirable.

(3.) The Manual Occupations satisfying these conditions, which have been most commonly adopted as specially suitable for the first, second, and third standards are:—

(i.) Modelling in Clay.
(ii.) Modelling in Cartridge or Cardboard Paper.
(iii.) Cutting out in Paper or other material.
(iv.) Drawing and Colouring designs (some original).
(v.) Brush Drawing from the Object and from recent impressions.

Other equally useful Occupations may no doubt be devised, and any Occupation that is proposed, if it is likely to prove satisfactory, will be readily accepted by the Department.

(4.) It appears that the various Manual Occupations which have hitherto been introduced for the lower standards because of their suitability, resolve themselves into exercises in the studies of (i.) Form, (ii.) Colour, (iii.) Measurement, which should be, where possible, connected with other subjects of instruction.

(*a.*) For acquiring a knowledge of Form, the most effective Occupation is Clay Modelling. It demands accurate observation of the object which is chosen as a model, and the accuracy of the observation will largely depend upon previous instruction as to the build or growth of the object in its natural state. Sometimes a lesson on Modelling has followed one on Natural History or Science; sometimes the children, after an Object Lesson upon the formation of a fruit or the germination of a seed, have modelled the object, thus at once testing the correctness of their impression and driving it home. Clay Modelling has been used to illustrate the Geography Lessons; for example, the children construct a model of the river basin in which they live; and again, illustration has been found for the History Lesson in constructing a model of some neighbouring encampment, whether square or circular, Roman or British. As a knowledge of Form depends upon a close observation of Light and Shade, a lesson in Modelling greatly furthers instruction in Drawing. Clay Modelling, however, lacks the charm of Colour.

(*b.*) Colour may be studied in the following ways:—When care is taken to provide a variety of tasteful shades of coloured paper, it is possible to combine the drawing, cutting out, and mounting of a number of good designs, many of which may be in respect both of pattern and arrangement of colour, the original work of the children themselves. The drawing may be done partly by aid of rulers and templates and partly freehand. The use of templates makes it possible to stamp on the mind certain beautiful curves at an earlier age than children can draw them freehand. This kind of exercise has been very fully developed by some of the officers under the London School Board. The advantages of it are that it promotes accuracy and good taste in colour and design, and also a sense of harmony and proportion. The defect of it is that the manipulation is somewhat monotonous, and that it does not lead to much increase of knowledge of varied objects.

(*c.*) Brushwork demands a clear perception of Form and some knowledge of natural objects, and cultivates delicacy of touch, but it does not train the student to great accuracy, or cultivate the sense of Colour. Children, however, can express their impression of a flower, as, for instance, a bluebell and its leaves, much more easily by the brush only than by the pencil, and if their observation has been very inexact, the error becomes obvious when they try to draw their impression.

(*d.*) As an exercise in accurate Measurement, Cartridge Paper or Cardboard Modelling leaves little to be desired. This work is an excellent training in exact measurement and in cutting true to measure, and it furnishes an elementary notion of construction. The manipulation, however, in this exercise also, is somewhat monotonous. This kind of work lends itself readily to the illustration of instruction in simple Geometry. The beginner may learn to cut out in Cardboard (or more readily still in stout Drawing-paper), simple plain geometrical figures, and after a time he may proceed to simple geometrical solids. The cube, the cone, the cylinder, the wedge, the prism and the pyramid can all be drawn, cut out, and put together without much difficulty. The manufacture of various useful articles, such as blotting books, frames, trays, and the like, can be combined with the formation of geometrical figures.

(*e*) As no one of the branches of Manual Occupation is complete when taken by itself, the most satisfactory results will follow where it is found possible to make them supplement each other.

5. Lastly, very great care is necessary in leading the pupils to acquire correct method in handling brushes, tools, and all the implements required. Another point which demands attention is that of the general posture of children during their lessons. Where much stooping is necessary, the work should be occasionally interrupted and a short extension drill given. Unhealthy and cramped postures should be avoided. Whilst fairly accurate work should be aimed at, you must beware of expecting very fine work requiring minute finish, or any work which is likely to strain the eyesight of young children.

6. My Lords have noticed with satisfaction that many of the larger School Boards have appointed Superintendents or Instructors of Manual Training, and have issued by their help excellent schemes of Manual Occupations for the lower standards. Some of these courses have already been published, and while it is contrary to the practice of my Lords to draw up any lists of educational works, you may remind Managers that particulars of such schemes can easily be obtained through the usual channels of trade.

I have the honour to be,
Sir,
Your obedient servant,
G. W. KEKEWICH.

To _____

H.M. Inspector of Schools.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the *coupon* which appears on the back wrapper of the current number of the Journal.
3. Correspondents will oblige by stating, whenever possible, the source from which their query has been obtained.
4. The Editor of the PRACTICAL TEACHER reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

J. B. Holmyard (*Midsomer Norton*).—Sum to infinity $1 + x(1+x) + x^2(1+x+x^2) + x^3(1+x+x^2+x^3) + \ldots$. *Lond. Univ. Inter. Arts*, 1894.

Let S = sum to infinity.

Then $S = 1 + x(1+x) + x^2(1+x+x^2) + x^3(1+x+x^2+x^3) + x^4(1+x+x^2+x^3+x^4) + \ldots$ (A)

Multiply each side of this equation by x.

Then $Sx = x + x^2(1+x) + x^3(1+x+x^2) + x^4(1+x+x^2+x^3) + \ldots$ (B)

Subtract (B) from (A).

$$S(1-x) = 1 + x^2 + x^4 + x^6 + x^8 \ldots$$

$$S = \frac{1 + x^2 + x^4 + x^6 + x^8 \ldots}{1-x}$$

$$= \frac{1}{1-x}(1 + x^2 + x^4 + x^6 + x^8 \ldots).$$

The factor $\frac{1}{1-x}$ has a definite value, and the other factor, $1 + x^2 + x^4 + x^6 + x^8$, is a G.P. having 1 for its first term and x^2 for its common ratio. This will sum to infinity if the common ratio x^2 is less than unity. By the formula the progression $1 + x + x^2 + x^4 + x^6 + x^8$, etc., summed to infinity $= \frac{1}{1-x^2}$.

$$\therefore S = \frac{1}{(1-x)(1-x^2)}.$$

J. W. Caruth, Aldford, Chester.—There are n points in a plane, no three of which are in a straight line, and the points are joined in pairs by straight lines which are produced indefinitely. How many straight lines are there, and how many triangles are formed?—Chas. Smith's 'Smaller Algebra.'

(*a*) The number of straight lines will be the number of combinations of n things taken two together.

By the formula, to find the number of combinations of n things taken r together, if N = the number of combinations required—

$$N = \frac{n(n-1)\ldots\ldots(n-r+1)}{\lfloor r}.$$

In the present case $r = 2$, and $(n - r + 1)$ becomes $(n - 2 + 1)$, that is $(n - 1)$.

$$\therefore N = \frac{n(n-1)}{\lfloor 2}$$

$$= \frac{n(n-1)}{2}.$$

(*b*) The number of triangles formed is the number of combinations of the $\frac{n(n-1)}{2}$ lines taken three together.

If N' = this number,

$$N' = \frac{\frac{n(n-1)}{2} \times \left\{\frac{n(n-1)}{2} - 1\right\} \ldots\ldots \left\{\frac{n(n-1)}{2} - 3 + 1\right\}}{\lfloor 3}$$

$$= \frac{\frac{n(n-1)}{2} \times \left\{\frac{n(n-1)}{2} - 1\right\} \times \left\{\frac{n(n-1)}{2} - 2\right\}}{\lfloor 3}$$

$$= \frac{\frac{n(n-1)}{2} \times \frac{(n^2-n-2)}{2} \times \frac{(n^2-n-4)}{2}}{3 \times 2}$$

$$= \frac{n(n-1)(n^2-n-2)(n^2-n-4)}{2 \times 2 \times 2 \times 3 \times 2}$$

$$= \tfrac{1}{48} n(n-1)(n^2-n-2)(n^2-n-4)$$

$$= \tfrac{1}{48} n(n-1)(n+1)(n-2)(n^2-n-4).$$

Herne Hill.—A number consists of three digits whose sum is 9. If the digits be reversed and their sum subtracted from the new number the result is thrice the original number. What is the number?

Let x = first digit;

y = second digit;

Then $9 - x - y$ = third digit.

Number $= 100x + 10y + 9 - x - y$

$= 99x + 9y + 9$

$= 9(11x + y + 1)$.

Now let the digits be reversed. The number so formed

$= 100(9 - x - y) + 10y + x$

$= 900 - 99x - 90y$.

The new number, less 9, $= 891 - 99x - 90y$

$= 9(99 - 11x - 10y)$.

$\therefore 9(99 - 11x - 10y) = 27(11x + y + 1)$.

Divide by 9.

$99 - 11x - 10y = 3(11x + y + 1)$.

$\therefore 96 - 13y = 44x$.

$$\therefore x = \frac{96 - 13y}{44}.$$

Now, since x is *ex hyp.* an integral positive number, we must find some integral positive value of y which will make it such. The only integral positive values we may give to y which will make x of positive value are the numbers 1, 2, 3, 4, 5, 6, 7. For, if $x = 8$, the fraction $\frac{96 - 13y}{44}$ has a negative value. The values 5, 6, 7 may be rejected, for any one of these would make $\frac{96 - 13y}{44}$ less than an integer. Taking in succession the values 1, 2, 3, 4, we find that

If $y = 1$, $x = \frac{96 - 13}{44} = 1\frac{39}{44}$.

If $y = 2$, $x = \frac{96 - 26}{44} = 1\frac{13}{22}$.

If $y = 3$, $x = \frac{96 - 39}{44} = 1\frac{13}{44}$.

If $y = 4$, $x = \frac{96 - 52}{44} = 1$.

We are certain, therefore that $x = 1$ and $y = 4$. The last digit is, therefore, 4, and the number = 144.

LEGAL AND CODE QUERY COLUMN.

☞ *N.B.—Our Replies in this column are not restricted to matters which are strictly professional. We shall be pleased to answer questions on legal difficulties which arise in connection with the private business of our readers, and also to give information on subjects of general interest. In fact, we will spare no trouble which may be necessary in order to answer in this column any reasonable question forwarded by a reader.*

RULES.

1. All communications must be addressed 'Legal Editor, PRACTICAL TEACHER, 33, Paternoster Row, E.C.' and must be accompanied by our 'coupon,' duly filled up.
2. Replies will be given *only* in this column, except under the conditions named in Rule 3.
3. If any reader desires a reply by post, such can be forwarded by enclosing, in addition to the coupon, a stamped addressed envelope and either stamps or a Postal Order to the value of one shilling.
4. No original documents should be forwarded, but copies only. We cannot hold ourselves responsible for any losses which occur through non-observance of this rule.

Double Session.—'DOUBTFUL.'—'Can I assemble my school at 9 a.m., mark the registers at once, again mark at 11 a.m. or quarter-past, closing at 1 p.m. or 1.15 p.m.?' My reply is:—'No, unless you have previously obtained the consent of H.M.I. to such a deviation from your time table.' Not under *any* circumstances will my lords consider two meetings of the school with less than half an hour's interval between them as admissible.

Stock Exchange Advertisements.—'L.G.R.'—The advertisement to which you refer is that of a firm who run what is known in the city as a 'bucket shop.' No broker on the Stock Exchange is permitted to advertise. On the whole, I believe betting on a horse-race is preferable to dealing with such a firm on the plan they advertise. It certainly is quite as moral, and more likely to be profitable. If you have any respect, either for your purse or your morals, do not be tempted by the cunningly baited hook. If the thing is as good as they say, do you think they would give you a chance?

Scholarship Examination.—'LUCY.'—The Department has suspended the rule as to 'Extra Marks' for successes in the South Kensington Examinations. At the Scholarship Examination in December 1896 marks will be awarded for successes in Drawing if gained at *any* previous examination of the Science and Art Department; for successes in Science if gained either in May 1896 or in May 1895.

Statistics.—'VOLUNTARYIST.'—Here are the figures you require:—

	Average Cost per Child in Average Attendance.		Average Annual Grant per Child in Average Attendance.	
	Voluntary Schools.	Board Schools.	Voluntary Schools.	Board Schools.
	£ s. d.	£ s. d.	s. d.	s. d.
1891	1 17 8	2 7 1¾	18 0¼	18 9¼
1892	1 17 9½	2 8 4¾	18 0¾	18 11
1893	1 17 6¼	2 8 1½	18 1½	18 11¼
1894	1 18 1¾	2 8 9¾	18 2¼	19 1¾

Twentieth Century.—'3RD YEAR P.T.'—Your friend is right. The twentieth century will begin at 12 midnight, at the commencement of the day which will be known as January 1st, 1901—not 1900.

Gyges.—'P.T.'—There are two personages referred to in ancient history who bore this name. The one to whom the ring belonged is said to have obtained the throne of Lydia under peculiar circumstances. As to the ring, Plato informs us that Gyges descended into a chasm of the earth, where he found a brazen horse, within which was the body of a man of enormous size, from whose finger he (Gyges) took the famous ring. This ring, when put on the finger, rendered the wearer invisible. So says the legend.

Certificate Examination.—'W.C.D.'—If you set as an 'Acting Teacher,' you obtain marks for successes in Science obtained at either or both of the May examinations next preceding the Certificate Examination. If you sit as a residential Student, you obtain marks for success in Science at the Examination held at your College. The number of marks awarded is:—Advanced or Honours, 100; Elementary, 75.

Devolution of Property.—'A 10 YEARS' READER.'—Should your wife die intestate, leaving the property you name, you will have no right to it. Had there been issue of the marriage, you would have been entitled to a life estate by what is technically known as the 'Curtsey.' If your wife wishes you to have the property, should her death precede yours, she should make her will at once.

Income Tax.—'X.Y.Z.'—Yes, the mortgagor can deduct the amount of tax from the amount he pays you as interest on the loan.

Damage.—'LANDLORD.'—Certainly you are liable. It is your duty to effectively secure the chimney pots to your house. The plea of a 'high wind' will not avail, if you leave your neighbour to take an action against you to recover damages for the loss occasioned by your negligence. I advise you to offer a reasonable sum as compensation, and thus avoid law costs.

Sloyd Courses at Nääs, 1896.—'THREE QUERISTS.'—Courses 74 and 75 are arranged from June 3rd to July 15th, and from August 4th to September 14th. Applications should be forwarded to Mr. J. Cooke, 131, Percy Road, Shepherd's Bush, W. (for Sloyd Association of Great Britain and Ireland); Mr. Regd. S. Yorke, B.A., Burley-in-Wharfedale, Leeds (Educational Handwork Union); Mr. R. Dickson, M.A., 9, Bruntsfield Gardens, Edinburgh (for the Scottish Association); or to Miss S. Garrett, Victoria College, Belfast (for Ireland). The blank-forms should be returned, duly filled up, to the Secretary who issued them, on or before March 31st next. The preliminary selection in England and Scotland will be made shortly after, and the final result sent *from Sweden direct*, for Course No. 74 in April, and for Course No. 75 in May.

Hiring Agreement.—'M.T.R.'—Without having before me an exact copy of the Memorandum of Agreement, I am unable to offer an opinion as to whether or not you can with safety delay the payment of instalments for the piano.

Memorandum of Agreement.—'INQUISITIVE.'—The terms of your agreement with the Board being as stated, you can certainly claim the books.

Replies by Post.—Replies have been forwarded to 'S.N.'; 'G.T.'; 'W.L.T.'; 'R.M.'; and 'Verae.'

EDUCATION ABROAD.

THE Punjaub University has arranged a course for the degrees of Bachelor and Doctor in Science, which wholly eliminates a classical language, and makes all the elective subjects branches of physical science. English is compulsory up to the Bachelor's examination.

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THE third International Congress of Psychology will take place on August 4 to 7 this year at Munich, under the auspices of the Royal Bavarian University. Tickets of admission can be obtained from the Secretary (München, Max Joseph-strasse 2) for 15 marks. This includes admission to the meetings, printed circulars, guides, and reports, and special terms for the social entertainments. Four languages may be used—German, French, English, and Italian. Intending essayists are requested to furnish short abstracts of their papers in advance, which will be printed and circulated among the members. Women are admitted on equal terms with men.

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THE Berlin professors do not seem to be taking kindly to the presence of ladies in their class-rooms. Although ladies are not yet admitted as regular students, but only in virtue of a special authorisation, the small concession meets with much opposition. Herr Schmidt, Professor of German Literature, is reported to have petitioned the Minister of Public Instruction with the view of having his course exempted from the application of the innovation. Professor Von Preitsetkey, the well-known historian of the Hohenzollerns, appears to regard such a formality as unnecessary. On a recent occasion, it is stated, he perceived a lady among his auditors for the first time. He hastily descended from his desk, approached the intruder, and offering her his arm, politely conducted her to the door.

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THERE is an article on the middle-class day schools for girls in Vienna in the *Educational Review*, which must be of interest to all promoters of female education. The author, Mr. A. S. Levetus, gives the following account of the origin of the system:—

'About twenty-eight years ago some ladies of Vienna, interested in education, and feeling the necessity of filling up the gap between the time of the passing of girls through the course of education provided by the State and their entrance into a profession or trade, formed themselves into a society, its aim being to further the higher education of women, and provide a useful industrial training for girls who, having completed the Bürgerschule course, wished to be fully equipped for their entrance upon the "battle of life."

'This Frauen-Erwerb-Verein now numbers over a thousand members. After many years of uphill work, and not without considerable drawbacks, the Lyceum and School of Art were, in 1891, recognised by the Government, received the same rights as public schools, and were granted State aid.'

The Lyceum now receives £600 a year. There is also a commercial school, a school of foreign languages (German, French, English, and Italian), and an industrial school, in which are taught art needlework, sewing, dressmaking, millinery, laundry work, hairdressing, and cooking. Hairdressing may appear a novel subject to our technical educators, but in Austria many women earn their living by hairdressing. They visit ladies every day, and keep in order and dress their hair. For this they receive a small sum varying

from 8s. 6d. to £1 from each lady every month. As the performance does not take many minutes, a good hairdresser will earn as much as £70 or £80, though the average would be much lower. They are paid extra, and at a much higher rate for dressing the hair for parties, balls, etc. The demand for the girls trained at these schools considerably exceeds the supply, and the venture must be pronounced an unqualified success.

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A REMARKABLE display of heroism by a teacher is reported from Ramburelles, Département de Somme. A large farmer of the neighbourhood was awakened on the night of the 16th January to find his farm on fire. Among the first to answer his call for help was a teacher, M. Duvauchelle. Hearing that an infirm old man was in the burning building, he rushed in, and succeeded with much difficulty in carrying him out. He then made his way into the stables, which were also in flames, and liberated the cows confined in them. The farmer then informed M. Duvauchelle, with tears, that a sum of money was deposited in a desk inside. The young teacher once more entered the burning dwelling, forced the locks, and brought the owner the drawers of the desk !

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THE Teachers' Union of the Département de la Seine has formulated a programme for temperance teaching in the public schools. It advocates the addition of chapters on temperance to existing reading-books, the introduction of additional books on hygiene, the provision of a popularly written book on the effects of alcohol, and the more rigid enforcement of the laws dealing with drunkenness and the selling of intoxicating liquor to children unaccompanied by their parents.

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INSTRUCTION in singing has now been placed upon a systematic and carefully-considered foundation in France. The new regulations came into force last year, and the *Revue Pédagogique* prints the official report upon the examinations of last October. The *certificat d'aptitude* comprises an elementary and a superior grade. The former includes an essay on a question of musical instruction, a musical dictation, sight singing, simple accompaniments, rudiments of musical theory, and practical blackboard instruction. The superior grade includes, in addition, questions in harmony, writing of accompaniments, transposition into suitable keys, and elementary history of music. The number of candidates examined for the lower grade was 97, 72 of which were women, and 39 were private teachers of singing or the piano, mostly women. Out of these 34 passed. For the higher grade the number of candidates was 63, 22 of whom passed. The examiners remark that the blackboard demonstration formed the most searching test as between good teachers and merely nominal ones. They also propose that no candidate entered for both the examinations in the same session should be admitted to the higher grade until he had obtained the lower grade diploma.

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M. JULES STEEG contributes an appreciative article on the educational work of the French Republic to the Belgian *Journal des Instituteurs*. The modern school system of France dates practically from M. Jules Ferry's appointment as Minister of Public Instruction in 1878. In 1881 primary education was made free, and in the following year it was also made compulsory. The most pronounced feature of the French school system is its absolutely lay, or, if you please, 'godless' character. 'Religion is the business of the Church and the Family' is the principle acted upon, and civil and moral teaching takes its place in the schools. This was finally established by the 'organic law' of 1886. In 1889 the State was made the only master over the teachers, thereby avoiding much uncertainty and litigation between communes and *départements*. As a result, there are at present 100,000 teachers, 60,000 public schools, with about six million pupils. The annual budget is 150 million francs. The outcome, it is said, of all this magnificent display of energy is the creation of a 'dead level of mediocrity.' That may be so, but it may also be true that this dead level is a high level indeed, and the 'greatest happiness of the greatest number' is the goal of all economists. It must be remembered, also, that the German schoolmaster won the Franco-German war, and the French schoolmaster may have some day to enter the field again.

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A CHATTY article on 'Popular Education in Greece' appears in the *Educational Review* from the pen of Miss E. Dixon. The education of boys and youths on an extensive and popular basis, from the elementary school to the University, is, she says, an accomplished fact, but that of the girls is still very much behindhand; and even in busy, modern cities like Athens and Nauplia many traces of quasi-Oriental seclusion of the female members of the household are found to linger. As regards male youth, there is too much 'education' in Greece, or, rather, the means of a secondary and liberal education are open to all to an extent entirely disproportioned to the needs of the country, and to its future material development and commercial prosperity. If there is one country where far-seeing statesmen may look with real anxiety at the growth of an 'intellectual proletariate,' that country would seem to be the kingdom of Greece. Every lad, whether of gentle or humble origin, may obtain almost gratis an education which will qualify him to enter upon a liberal profession. Hence there is a regrettable dearth of craftsmen, skilled artizans, and cultivators, and a surplusage of barristers, politicians, and other professional men, with nothing to do. A vast proportion of the country, more especially in the Peloponnesus, is still lacking in even moderately passable roads. Inns, outside the chief towns, are of the most primitive description, washstands being unknown, and beds mere *στρώματα* on unclean floors. Such railways as exist convey suggestiveness of having been 'made in Germany,' and appear to be worked on a more or less go-as-you-please basis.

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THE subjects of instruction in the elementary or 'Demotic' schools are Religion, Hellenics, Gymnastics, Drawing, Arithmetic, Writing, Geometry, History, Geography, Natural History, Physics, and Singing. The inclusion of 'Hellenics' in the Demotic curricula strikes one at first sight very favourably. One begins to speculate upon the patriotic Greek training the young child from its most tender age in the 'Hellenic idea,' and the past glories of the Greek race. Consequently, one experiences a shock when it dawns on one that 'Hellenics' correspond, after all, to the 'English' of our own elementary schools, viz., reading, writing, grammar, the learning of poetry, and object-lessons. It is interesting to note that among the 'common things,' knowledge of which is taught in the lowest Standards, are cooking utensils, gardening tools, musical instruments, weapons (even in the First Standard !), washing of clothes, rural employments, simple hints as to cleanliness, doing hair, etc., and elementary botany. The 'common flowers' are the rose, violet, hyacinth, narcissus, crocus, and lily, white and coloured; not the asphodel, which is so common in Greece that it is perhaps regarded merely as a weed that springs up on waste ground and rubbish-heaps, as well as on Homeric meads.

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THE following specimen of 'Deductive Reasoning' appears in the *Journal of Education*:—

An Ohio teacher, who is an earnest advocate of Pestalozzian principles, furnishes us with an example of deductive reasoning which evolved a conclusion as natural as it was original. Preparing her language class for written work upon the subject of 'The North American Indian,' she elicited the familiar facts that, among the tribes, the 'lords of creation' are known as chiefs or braves, according to station.

'Now, children,' she continued, 'what shall we call the Indian woman ?'

'A squaw,' is the ready answer.

'What is the little Indian baby called ?'

The silence of deep thought prevailed for a few moments. At last a brilliant expression flashed across the face of ten-year-old Lizzie, and, with sparkling eyes, she quickly raised her hand.

'Well, Lizzie ?'

'A squash !'

OUR SCOTCH LETTER.

'Cordon Bleu.' Things begin to look a little livelier for the summer and autumn in Institute circles. It was too hastily assumed that the first essay in the region of democratic election with respect to the President was to result in a walk-over for last year's second, or at most a duel of the good old-fashioned type between him and some other rising man in the inner councils. The experience of the last few days has dispelled the delusion—Paisley has nominated one of its own members, Mr. Thomson. The lead has been promptly followed by one or two others. This introduces another element of uncertainty into the contest, and brings into prominence once more Lord Beaconsfield's caution regarding the town of thread and cornflour.

'Unto these my brethren.' The institution of the Benevolent Fund is still the chief topic in professional circles. Its compulsory form caused some head-shaking, which gave some anxiety to the men in office—central as well as local. As a result, meetings were organised to minimise, if possible, the doleful forebodings. These have made it clear that the apprehended danger will not arise from active opposition, but rather that the enemy to be feared is apathy. This also would seem to be localised in the older members. Apprehension at one time existed that the increase in membership fee would act adversely in the numbers attracted to the standard. Reports from the various districts satisfactorily dispose of this fear, and dread has now concentrated on the possibility of lapsing.

'A Well-Graced Actor.' It is now taken for granted that the present year—the jubilee of our incorporation—will witness the disappearance from the stage of active duty of one of our most notable figures. The present general secretary, Dr. Smith, of Uddingston, has for the last fifty years occupied a leading position in all scholastic movements north of the Tweed. The gentle Scotch hint which he gave at the last annual meeting is, it appears, to be carried out at the next, and its execution will raise some important questions, whose settlement will materially affect the organisation of the profession. A large section of the membership—probably the majority—incline to the combination of all the offices of the Institute, and the appointment to the conjoined duties of one whose whole time would be devoted to the work. However that may work out, neither that view nor any other should be allowed to interfere with Dr. Smith's paramount claim to handsome treatment in the way of a retiring allowance.

An Old Controversy. The vexed question of the need of some historical teaching in our elementary schools received new and effective treatment from Professor Lodge, of Glasgow University, before the Glasgow Local Association, the other Saturday. It is scarcely too much to say that the lecture of the learned professor proved a literary refreshment, even to those who might be opposed to his position. Besides exposing the absurdity of the incomplete curriculum, which encouraged geography while discouraging history, the lecturer made a strong point of an historically ignorant electorate. There would always, in such circumstances, be the freest possible field for 'the swing of the pendulum.'

'A Legal Quibble.' Three miles would, in Scotland, appear to be the limit within which compulsory attendance can be legally enforced. For families outside that radius special provision must be made, or they are held to be exempt from the legal responsibility. The Code in such cases holds out increased money payments on the examination of children taught by an itinerant teacher. It throws a vivid sidelight on the sparseness of population in some districts of our country to find some Boards in the extreme north and south forced by circumstances to make provision for such outland cases. It shows also, for the thousandth time, the absurdity of expecting a general statute to provide for all the cases which may arise.

To be Commended. Kirkconnel School Board, in the south, had, by the force of circumstances, to specially consider the educational requirements of a small outlying population. By a very sensible arrangement it made a money payment for the board and lodging of the pupils in the vicinity of the nearest public school during the winter, on the condition that they submitted to the inconvenience of the long walk in the summer months. This plan was actually a saving of money, and in addition secured the advantages to the children of a regular school course, instead of the perfunctory attentions of a 'wandering' dominie. The auditor of the Scotch Education Department has, however, ruled such personal payments illegal, and thus it would appear that this enlightened local authority must perforce go back to the dear and inefficient system. Dogberry's general opinion of the law would scarcely appear too severe a stricture in the present instance.

Trouble in Linlithgow. There is educational unrest in the historic town of Linlithgow. Like other parishes which include a Royal or Parliamentary Burgh in their confines, this one enjoys the doubtful advantage of two independent School Boards, a Burgh and a Landward. The distribution of the Secondary Education grant caused here, as elsewhere, a desire for centralisation on the higher subjects, and a compact under which a joint school was erected was the result. The findings of managers, however, often ignore the aspirations of teachers, and it has become plain, after two years' experience, that the higher subjects are still being vigorously prosecuted in the common schools of the Landward district, to the detriment of the combined school. Hence the rector betakes himself to a new sphere, and the secondary master resigns.

'Spare the Rod.' Bo'ness is also in hot water, though from a totally different and more ancient cause. There the old 'bogey' of corporal punishment has, like the sea-serpent, been resuscitated. No one, except a teacher who has served under 'what was and what is,' can appreciate to the full the more humane methods of the present system. It is, however, all the more imperative to expose any violations of the modern spirit in this respect. Words like these from the lips of a School Board member can hardly be taken literally as expressing in any measure the state presently prevailing: 'Children are brought to the brink of the grave by indiscreet punishment, and sent forth to the battle of life maimed and crippled.' In the interests of teaching we are pleased to see that the head-masters of the old-time burgh resent the imputation conveyed in these grossly exaggerated and misleading expressions.

Demand and Supply. If the action of the School Board of Edinburgh be imitated to any extent the educational problem of the future will be 'find the supply.' At their recent meeting it was decided to reduce the number of pupil-teachers to the lowest limit short of abolition, and to confine their operations practically to the Infant Department. For a number of years the county has depended to a large extent on the pupil-teachers of the larger School Boards for its supply of trained teachers. The *genus* did not pay in rural districts. Their training absorbed more energy than their services were worth. The new Edinburgh policy emphasises the necessity for devising some satisfactory scheme of professional training for teachers which may take the place of the doomed system.

A Nice Point. The School Board of Cupar-Fife has lately had under consideration one of those anomalies which our cast-iron system of examination has generated. To the average parent, it presents all the elements of a complete puzzle. A child, say, fails in two subjects in Standard V. Often, very often, a hair-breadth represents the difference between 'pass' and 'fail,' and it does seem hard that the careless or the nervous should for want of that infinitesimal quantity be doomed to plod the same dreary round for another year; or, what is more to the purpose of most parents, be denied the freedom of the labour certificate. Of course, there exists no hindrance to advancement to Standard VI.; but take this course, and in many cases complications arise. The attendance becomes irregular, and the parent is summoned. The defence

—and a very colourable one it is—is that the child is in Standard VI. It would take, as we say in Scotland, 'a Philadelphia lawyer' to convince the parent that a child could be placed in that grade without having passed the previous 'go.'

'Spread the Light.' A circular has lately been issued from the office of the E.I.S., which gives in summarised form the advantages which that Corporation claims to have bestowed on the general body of teachers during the fifty years of its existence. In this connection, it is worthy of notice that the General Treasurer is at present employed in missionary labour in the outlying districts. Together, these things seem to indicate that a better day is in store for the professional organisation, and it may be said that it cannot come a day too soon. The Doctor's arguments are tame enough to be safe. Take this: 'School Boards, as a whole, were well disposed to treat teachers fairly, but unfortunately cases occurred in which the personal hostility of one or more members all but ruined the teacher's career.' There can be only one plan of resistance to any such one-sided system: complete union, as thorough and final as self-interest can make it.

THE CLASS TEACHERS' COLUMN.

BY C. H. MOORE.

Ex-President of the National Federation of Assistant Teachers.

It has long been a source of complaint among the many class teachers throughout the country that there existed no medium through which a free ventilation of their questions could be obtained. It cannot be denied that although the interests of the class teacher and those of the head teacher are not (or never should be) antagonistic, they are not always identical. The existence of a now powerful organisation in the Assistants' Federation, the many influential associations of class teachers in the large centres of the country, and the noteworthy influence which the class teacher now possesses in the conferences of the N. U. T., point to the fact that the large body of teachers whose position in the profession is to be a permanent one, are desirous of establishing for themselves a status commensurate with their educational equipment and training. It is with the view of aiding in the accomplishment of this desideratum that this column has been initiated. When the editor asked me to take charge of this department I felt that he had realised a long-felt want, and it will be my duty from time to time to deal with such matters as directly affect the class teachers of the country. In order to do this efficiently, I shall welcome any communications from my colleagues which may be dealt with in such a manner as to create professional interest. Information concerning remuneration, conditions of service, &c., &c, in various districts will be particularly acceptable, and the writers may rely on the source (if necessary) being kept strictly private.

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On Saturday, March 7th, I visited the North Staffordshire Association of Certificated Class Teachers. The information I gleaned from that locality is not of an inviting nature. The maximum salary to be realised in the district is £100 per annum, and this is not attained by stages of facility. The School Board for Newcastle-under-Lyme actually have a regulation which provides that only one certificated class teacher shall be engaged in their senior schools, and in infants' schools no qualified practitioner shall have charge of a class. It is almost impossible to believe that in a centre remarkable for its commercial enterprise such a state of circumstances could be found to exist. The Newcastle School Board have evidently made up their minds that education is of no value, that their position is not one of an educational authority, and that the children under their care are either endowed with an intuitive precocity which enables them to attain an educational altitude by the mere process of nature, or that the children of the neighbourhood have no claim to that efficient tuition which is generally supposed to be the prerogative of every British child. It is plainly the duty of some one to enlighten the people of Newcastle on the real necessities of the situation; and while they are about it, it would be just as well if it were pointed out that a maximum salary of £85 will not attract the ablest teachers in the profession. The Hanley, Stoke, Burslem, and Wolstanton School Boards might, with advantage to their local educational efficiency, consider the question of the proper remuneration of their teachers.

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We are now almost on the eve of the N. U. T. conference. One of the most remarkable signs to one who has regularly attended the conferences of the past few years has been the development of the representation of the class teachers at the teachers' parliament. This is very gratifying, insomuch as it displays a willingness on the part of all sections of the profession to give that attention to the questions affecting the class teacher to which the permanent nature of his position entitles them. The willingness of every candidate for executive honours to consider the same questions is another significant sign of the times. A perusal of the agenda for conference reveals once again the fact that many important matters are relegated to the oblivion of the supplementary agenda. The questions of large classes and schools, the need for a sustentation fund, and the advisability or otherwise of reorganising the union appear to be details of minor importance. Well, there is the consolation that no 'muzzling order' is submitted in the Code of Standing Orders. I trust that every class teacher present at Brighton will see the necessity for the closest attention to the proceedings of conference. Brighton is an attractive place.

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The handbook issued by the National Federation of Assistant Teachers will shortly be ready for publication. In it is incorporated the salary pamphlet which received so much attention last year. Many other items have been included, and the publication will, on the whole, be indispensable to the class teacher. To the student leaving training college this book will be a boon, as the scales of salaries of the leading school boards are given, and, what is far more important, notes are appended showing how the scales are (or are not) carried out.

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It will be remembered that the Burton Conference of Assistant Teachers decided to present an address on vellum to Mr. Macnamara as a small appreciation of his services to our cause. The presentation will be made at Brighton. The Brighton Class Teachers' Association will entertain all class teachers attending conference to tea on Monday evening. Representatives should write Mr. J. Andrews, 17, Richmond Hill, Brighton. A business meeting will be held after tea.

COURSE 'B' IN ARITHMETIC.

A COMPLETE SYLLABUS FOR A YEAR, IN MONTHLY SECTIONS, WITH TESTS.

BY B. ELDERKIN,
Model School, Westminster Training College.

For Introductory Notice and First Month see February number of PRACTICAL TEACHER.

STANDARD I.

Syllabus—3rd Month.

(*a*) Addition in two figures.
(*b*) Subtraction of numbers up to 50.
(*c*) Four times table.
(*d*) Multiplication by 2 and 3; no number used to exceed 50.
(*e*) Division by 2; no number used to exceed 99.

Test.

1. How many marbles are 15, 8, 29, and 13 marbles?
2. How many are 41 oranges more than 28 oranges?
3. What are 2 times 17? also 3 times 13?
   ,, 2 ,, 21? ,, 3 ,, 14?
   ,, 2 ,, 24? ,, 3 ,, 15?
4. How many two's can I get from the following numbers:—27, 38, 42, and 59?

STANDARD II.

Syllabus—3rd Month.

(*a*) Sums in first four rules not to exceed 10*s.*
(*b*) Nine times table.

Test.

1. Add together 1*s.* 3½*d.*, 2*s.* 7¾*d.*, 1*s.* 10½*d.*, and 3*s.* 8½*d.*
2. Take 3*s.* 9*d.* from 8*s.* 6*d.*
3. Five brothers have each 1*s.* 10½*d.* in the bank; how much have they altogether?
4. Divide 9*s.* 9*d.* among 4 boys.

STANDARD III.

Syllabus—3rd Month.

Simple and Compound Multiplication and Division by 21, 31, 41, etc. Introduce hundreds in Simple, and pounds in Compound sums.

No amount used to exceed £20.

Test.

1. How many pencils are there in 21 boxes, if 1 box contains 45 pencils?
2. If I put 961 pencils into 31 boxes, what equal number should each box contain?
3. Find the cost of 31 suits of clothes at 11*s.* 9*d.* each.
4. Divide £19 13*s.* 9½*d.* by 41.

STANDARD IV.

Syllabus—3rd Month.

Long Measure. Four rules, with multipliers and divisors up to 99.

Test.

1. A wire is 15 yds. 9 ins. long, another is 13 yds. 2 ft. 4 ins., and a third is as long as the first and second wires together. Find the total length of the three wires?
2. If 15 yds. 2 ft. 10 ins. be cut from a rope 36 yds. long, how much will be left?
3. Find the total length of 56 pieces of wire each 13 yds. 1 ft. 7 ins. in length?
4. A fence 39 yds. 2 ft. 8 ins. encloses a square garden; what is the length of each side of the square?

STANDARD V.

Syllabus—3rd Month.

(*a*) Multiplication and Division of Fractions.
(*b*) Reductions in Time Measure.

Test.

1. Divide the product of $6\frac{3}{8}$, $7\frac{1}{5}$, and $1\frac{7}{9}$, by $7\frac{1}{2}$.
2. Find the cost of $4\frac{3}{4}$ yds. of cloth at $7\frac{1}{4}$d. per yd.
3. $(\frac{1}{3} + \frac{1}{5} - \frac{1}{8}) \div (2\frac{3}{4} \times \frac{8}{9})$.
4. (*a*) Change 5074 minutes into days.
   (*b*) Change 5 yrs. 7 mths. into days.

STANDARD VI.

Syllabus—3rd Month.

(*a*) Reduction of Decimals.
(*b*) Concrete values in Decimals.
(*c*) To make equal ratios.

Test.

1. (*a*) Reduce 5*s.* 6*d.* to the decimal of £1.
   (*b*) Reduce 7½ stones to the decimal of 1 ton 10 cwt.
2. Find the value of—
   (*a*) ·0625 of £1.
   (*b*) ·6875 of 5 cwt.
3. Add together ·225 miles, ·225 furlongs, and ·25 chains.
4. Complete the following proportions:—
   (*a*) 3 : 8 :: 15 : (*x*).
   (*b*) 18 : *x* :: 9 : 6.
   (*c*) 5 : 90 :: (*a*) : (*b*).

STANDARD VII.

Syllabus—3rd Month.

Averages.

Test.

1. 3 cows cost £1 10*s.* 6*d.* each, 5 cost £2 2*s.* each, 4 cost £1 15*s.* 6*d.* each, and I pay £36 for 8 others. What is the average cost of each cow?
2. One parcel weighed 3 cwt. 2 qrs., a second 2 cwt. 3 qrs., and a third 5 cwt. 1 qr.; what must the fourth weigh so that the average weight of the parcels may be 4 cwt. 1 qr.?
3. What would be the price of 1 lb. of the following mixture:—13 lbs. tea, at 2*s.* 8*d.* per lb.; 15 lbs., at 2*s.* 4*d.* per lb.; 18 lbs., at 2*s.* 10*d.* per lb.
4. Find the average value of the following:—$\frac{3}{5}$ of £1; ·05 of 10*s.*; ·125 of 6*s.* 8*d.*; ·1875 of 13*s.* 4*d.*; and $\frac{9}{11}$ of 1 guinea.

TESTS—THIRD MONTH ANSWERS.

Standard I.—None required.

Standard II.—(1) 9*s.* 6*d.* (2) 4*s.* 9*d.* (3) 9*s.* 4½*d.* (4) 2*s.* 5¾*d.*

Standard III.—(1) 945. (2) 31. (3) £18 4*s.* 3*d.* (4) 9*s.* 7¼*d.*

Standard IV.—(1) 58 yds. 2 ins. (2) 20 yds. 2 ins. (3) 757 yds. 1 ft. 8 ins. (4) 9 yds. 2 ft. 11 ins.

Standard V.—(1) 12. (2) $3\cdot0\frac{1}{8}$. (3) $\frac{88}{89}$. (4) (*a*) 3 dys. 12 hrs. 34 mins.; (*b*) 1876.

Standard VI.—(1) (*a*) ·275; (*b*) ·03125. (2) (*a*) 1*s.* 3*d.*; (*b*) 3 cwt. 1 qr. 21 lbs. (3) 2 fur. 2 pls. (4) (*a*) 40; (*b*) 12; (*c*) none required.

Standard VII.—(1) £2 18*s.* $2\frac{1}{10}$*d.* (2) 5 cwt. 2 qrs. (3) 2*s.* $7\frac{1}{22}$*d.* (4) 5*s.* $0\frac{4}{5}$*d.*

EXAMINATION BLUNDERS.

AN article on 'The Philosophy of Blunders' which appears in the March number of *Blackwood* is likely to be of some interest to teachers. It cannot be said that blunders are so rare that the mere fact of their occurrence has any interest, nor is the manner in which they are sometimes retailed for the public amusement such as to command the sympathy of the profession. The special feature of the article referred to is the attempt made to regard the blunder from its more philosophical side, as the outcome of a mental process which is susceptible of rational explanation.

WHAT IS EXAMINATION?

Examination is regarded as the completion by the pupil or student of a train of thought suggested by the examiner.

'The process of examination may be regarded as a kind of thinking by proxy, or of co-operative thinking, either in the form of reminiscence or of reasoning.'

'That is, of course, looking at it from the examiner's point of view. From the side of the *examiné* there is, unfortunately, nothing vicarious in the proceeding—it is severely personal.'

HOW BLUNDERS ARISE.

Common blunders are classified generally as those of memory and those of reasoning. Those of memory are first dealt with.

'In the first place, there may be ignorance of certain facts or events embraced in it. Again, the clue given by the examiner may be insufficient to suggest the next link in the series; and this may result either from a real defect in the form of the question, or from

a relative defect as regards some individual pupil who has been accustomed to a more suggestive form of question. Or again, at some point in the chain, some irrelevant series of ideas may appear instead of that expected by the examiner.'

Blunders in reasoning are thus accounted for.

'The data supplied by the examiner may be insufficient, misleading, or misapprehended. There may be a weakness of the reasoning power which might fairly have been expected from the pupil, either general or confined to the subject of examination. Or there may be a want of information as to the subject, or an imperfect memory of the facts required, due to any of the various sources of incorrect reminiscence mentioned in the preceding paragraph.'

Teachers will be ready to note one statement which occurs in this connection :—

'It may even be broadly asserted that in perhaps a majority of cases of blunder, as distinct from mere failure to answer, the examiner is responsible rather than the pupil.'

'Widow' and 'Window.'

Some examples are given of blunders due to imperfect or misleading questions.

'A little boy in the course of his reading lesson came to the word "widow," and called it "window," a word more familiar to him. The teacher, who was acting as examiner, corrected the blunder, and then, wishing to improve the occasion, put the question, "What is the difference between 'widow' and 'window'?" The boy's answer began, "You can see through a window, but——" and then stopped. The amusement plainly visible on the teacher's face prevented this miniature Sam Weller from completing the contrast. Now, the blunder here, so far as it was a blunder, was entirely due to the teacher. He did not mean to impress on his pupils the transparency of a window as contrasted with a widow, but the difference in spelling between the two words.'

A-Stonished !

Elliptical questioning, which is described as a form of the 'missing word competition,' is responsible for the following example :—

'The subject of lesson was the "Miraculous draught of fishes." "Simon said, We have toiled all night and caught nothing," quoted the teacher ; "then they let down the net, and enclosed a great multitude of fishes : now, then, Simon was a——?" "Disciple," replied one lad. "Apostle," another suggested ; but these answers were waved aside. The quotation was given again, and this time the apparently pertinent answer "Fisherman" was offered, but not accepted. The class was now quite at a loss to see what particular aspect of Simon was in the teacher's mind. One more trial he made, emphasising the contrast between "catching nothing" and "enclosing a great multitude of fishes." One boy saw the contrast clearly now, and drew a startling conclusion ; "Now, then," the teacher repeated, "Simon was a——?" "Lear," replied the boy, and for the sake of euphony we leave the answer in the boy's own dialect. The teacher was somewhat shocked, no doubt, and the class somewhat amused, but the question was not answered. And so the teacher began the quotation again, this time filling up the ellipsis himself. "Now, then," he concluded, "Simon was *astonished*." And no doubt so were the pupils, as well as the other listeners.'

Reasoning for Memory.

Some amusing instances are given of errors arising from the attempt to supply the deficiencies of memory by original reasoning or conjecture.

'The subject of a lesson was the triumphal entry into Jerusalem. "Why did the people strew palm-branches in the way?" asked the teacher. One pupil, impressed no doubt by the hostility of one section of the Jews rather than by the enthusiasm of the other, gave the startling explanation, "To trip the cuddy."'

Attention is also called to the attempts which children make to put a meaning into the words which they are often required to learn sometimes without sufficient explanation.

'Some such instinct it must have been that led a little boy recently to repeat the children's favourite psalm with a variation of his own, thus :—

"My table Thou hast furnished
With presents from my foes"

—not an unreasonable rendering if he had ever read the story of "spoiling the Egyptians."'

This tendency has been the cause of many well-known errors among adults as well, if the story is true that a rustic swain, imperfectly acquainted with the words of the marriage service, cheerfully promised before the officiating clergyman to 'love, honour, and cherries,' but expressed some doubts afterwards as to what he had bound himself to do in the mysterious words 'with all my worldly goods I, thee, and thou.'

Many corruptions of words are due to a similar cause ; the sailors of the beginning of the century are said to have named the ships *Æolus* and *Bellerophon* the 'Ale-house' and the 'Bully ruffian,' and no doubt felt some satisfaction in being thus enabled to use words which were not mere sounds.

Verbal Memory.

Where memory is merely verbal, errors arising from the similarity of two words, especially two proper names, are common. Many examples of this type of blunder are quoted from the examination papers of pupil-teachers and training college students.

'John Wesley joined the Navy in 1779, and by degrees rose to be Duke of Wellington.'

'Sir Thomas More lived in the reign of William ; he was a great poet ; some of his poems were "Cœlebs in Search of a Wife," "Ye Mariners of England," and "The Descent of Man." He was also one of the greatest preachers of his time.'

'Sir Thomas More, a famous general, born in Ireland, wrote several essays and poems. He was killed at the battle of Corunna.'

'Gibraltar was seized by Richard Hooker.'

'Charles I. imprisoned nine members ; among these was George Eliot.'

'The Maid of Norway was the grand-daughter of Alexander the Great.'

Faith in the Text-Book.

The same type of memory is shown to lead to the reproduction of statements from a book so changed as to be quite irreconcilable with known facts, without any apparent consciousness of the absurdity of the statements as given.

'Even chronology, which is the crammer's strong point, goes astray under the effort to reproduce statements seen somewhere in a text-book. For example, "During the reign of Queen Elizabeth one of her most able supporters was Cranmer, a Protestant. During the reign of Queen Mary, Cranmer was burned for heresy," a statement made by a student who could not possibly be ignorant of the fact that Mary's reign preceded that of Elizabeth. Again, "Montfort was the chief man in getting the Constitutions of Clarendon passed in 1158, fought at Lewes in 1264, was killed in 1265," a statement made by one who must have been aware that she was assigning to the good earl a public career of 107 years. But these students had determined to rely on memory for their answers, and it did not occur to them to apply their common-sense to check the result.'

Girls as Scientists.

'In dealing with blunders in scientific subjects, the chief cause of error is shown to be the attempt to remember something out of a book. The opinion is advanced that girls are more prone to err in this respect than boys.

'Girls are more ready than boys to inform the examiner that "a circle is a figure bounded by one straight line," and perhaps only a girl could have defined a point as "that which has length and breadth but no magnitude."'

In this connection some remarkable statements are quoted from students' papers.

'One training college student explains that "we have summer in this country when the North Pole is turned towards the equator," a condition which, if indispensable, would make our chances of fine weather somewhat worse than they really are.'

'"A solar day is the length of time between the sun's rising and setting,"—this is a blunder of little consequence so far, as it may be due to mere ignorance of what the term "solar day" is used to express, but the serious part of the answer follows :—"it is twenty-four hours." Surely no intelligent young woman of eighteen or twenty would assert the time between sunrise and sunset to be twenty-four hours unless she supposed that science required her to say so.'

'The influence exerted by the moon upon the waters of the earth is explained as being due to the moon's attractions. The recurrence of this slip in several papers raises the question whether it is really a mere slip of the pen, or whether the fair writers regard what is popularly described by the word "attractions" as being the universal drawing-power in nature, animate and inanimate alike.'

A Wide 'Subject.'

The fact is recognised that errors may occur, for which neither the examiner nor the student are entirely to blame, but which are due to the fact that there are subjects which "no fellow can understand."

'Among all the *quasi*-scientific subjects of the teacher's curriculum, domestic economy stands easily first in providing pitfalls for the student. Nor is this to be wondered at, considering the great and catholic width of the so-called "subject." Political economy is an exact science in comparison with it. Laundry-work and life-insurance, dressmaking and dietetics, savings banks and sanitation,

housework and hygiene, physiology and "first-aid"—all these and more invite the young teacher's attention, and lie in wait for her at her professional examinations.'

The confusion of thought induced by the attempt to deal with this '*pot-pourri* of science' is shown to extend even to the spelling of common as well as of scientific terms, while clearness of expression often disappears.

'The wish for brevity leads one to say that French women use "their own clarified fat" in cooking, and another that a school kitchen should have "space enough to allow six or eight girls to cook at once," while yet another tells us that a certain dish may be eaten cold twice." Such ambiguities are probably due more to haste than to any other cause, and are hardly to be classed as absolute blunders, notwithstanding the anthropophagous suggestions of the two first.'

Many blunders naturally occur due to a confusion between two unfamiliar terms.

'A few examples of such substitutions are the following:—"The vessel, crew, and cargo must be thoroughly disinfected with hydrochloric acid," probably a more effective if less pleasant treatment than disinfection with chloride of lime, or whatever may have suggested the term; a teacher "finds his energy flag, and finds himself becoming disinterested and exhausted,"—an unexpected moral result from hard work, or from having "to baffle against a vitiated atmosphere," as another paper has it; disease-stricken ships should be "kept in quadrantine," and the passengers "not allowed to come on shore until after a fortnight's furlough," which puts the case in rather euphemistic form.'

'Bulls.'

In a subject so full of confusion, it is not surprising to find that the type of confusion known as the 'bull' is occasionally met with in students' papers.

'Papers in this subject also contain an unusual proportion of expressions somewhat suggestive of the Emerald Isle; for example, "Every house not yet infected should be disinfected"; "The body is covered with little holes"; "Girls of all ages"; "The nurse should not mix with any one except the doctor"; "For tea she might get a little cocoa"; and "One breath of pure morning air is worth a dozen of moonlight." The following is a more detailed example of the same type, the reference being to penny dinners at school:—"Each child receives a good deal more than a pennyworth, but the loss is not great when a great many children buy." Outside a "scientific" paper this statement could never have been made by the writer.'

A Dilemma.

The moral aspect of students' blunders is touched on towards the close of the article, and this is a question which will bear some consideration.

In children's blunders the moral aspect may be ignored.

'But the higher examinations quoted from are, to a certain extent, professional examinations, and on the results of them the student's professional career and emoluments may, to a certain extent, depend. So the question arises, more of a moral than an intellectual question, Is this a *bonâ fide* blunder? Did the writer suppose that this answers the question? Or does he know that he cannot answer the question, but know also that he *cannot afford* to leave it unanswered? Is he not merely "having a shy" at it in order to secure a few stray marks for his total: And if the blunder be, like so many quoted already, a hopeless confusion regarding things perfectly well known even to very imperfectly educated people, this question is apt to take the form of an awkward dilemma: Has his education merely blunted his common-sense? Or has it blunted his moral sense also?'

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

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PUPIL TEACHERS' COURSE.

Scheme of Work for the Month.

Work to be Prepared.

A.—*English.*

First Year.

1. Conjunction—Definition and Classification.

Note under Classification that this may be done on several bases—the meaning of the word, the kind of sentence it introduces, its derivation, etc.

2. Revise all suffixes. Next month we shall probably be able to start the study of the special poems.

3. Learn 10 roots and meanings per week.

Second Year.

1. Revise Latin Prefixes and Suffixes.

2. Learn 15 roots and meanings per week.

Third Year.

1. English Literature, 1649–1700. Note Butler and his 'Hudibras,' Dryden, Jeremy Taylor, Hobbes, Bunyan, and Locke.

2. Learn 20 roots and meanings each week.

B.—*Arithmetic.*

First Year.

Boys.—Lock. Miscellaneous Examples LIX.

Girls.—Dixon and Beach. Read Chapters XIV. and XV., and work Examples set.

Second Year.

Boys.—Lock. Examples CXX. and CXXI. Adopt Method shown on p. 195.

Girls.—Dixon and Beach. Read Chapter XXVI., and work the Examples thereon.

Third Year.

Boys.—Lock. Examples CXLI. and CXLII. Square and Cube Root.

Girls.—Dixon and Beach. Read Chapter XXIX. and work Exercises on it. Make quite sure of the difference between Ratio and Proportion, and between Solution by Proportion and by Method of Unity.

(N.B.—The greatest care must be taken in all solutions and problems in Arithmetic to secure a well arranged and logical exposition of the method. Getting a correct answer is not sufficient by any means. The specimens of work sent up for criticism are very deficient in this respect, and the figures are often very poor and unsatisfactory.)

C.—*Music.*

All Years.

Revise any weak points and answer the questions below. Do not neglect the practical work, and pay especial attention to the method of writing the various measures.

D.—*Spelling.*

Learn 200 words from 'Words Commonly Misspelt' (2nd Series), or any good list. Test frequently by Dictation.

E.—*Geography.*

Asia.—

Physical Features, Climate, and Productions.

Notes.—1. *Name*—'Asia' probably derived from an Assyrian root meaning *East*. Europe and Asia are sometimes spoken of together as Eurasia.

2. *Extent* 4,000 miles by 5,000. Area 17½ millions square miles. 5 times Europe and ⅓ of all the land on the globe.

3. *Coasts.*—(*a*) Arctic—Mostly icebound, nearly impossible to sail the whole length in one summer—a feat performed, however, by Nordenskjold.

Openings: Gulf of Obi, Gulf of Yenesei, Katanga Bay.

Most northern point Cape Severo or North Cape—usually known by its Russian name of Cheyluskin. The Liakhov Islands frequented by whalers—fossil ivory found. The low-lying Tundras similar to those in Europe.

(*b*) Pacific.—Washed by a warm current, the Kuro Siwu or Black Stream, similar to the Gulf Stream, Gulf of Anadir in Sea of Kamschatka, Peninsula of Kamschatka, terminating in Cape Lopatka; Sea of Okhotsk barred by the Kurile Islands; Sakhalin and the Japanese Archipelago (Yesso, Nippon, Sikoku and Kiusiu), The Corea, Yellow Sea with the Gulf of Pechili, Formosa, Hainan and Loochoo Islands. The China Sea, Gulf of Siam and Malay Peninsula. The Islands of the East Indies.

(*c*) Indian.—Note similarity with Europe. Arabia = Spain, India and Ceylon = Italy and Sicily, Malay Peninsula and East Indies = Greece and Islands of the Archipelago. Bay of Bengal, Persian Gulf and Red Sea.

4. *Straits.*—Behring between Asia and America.
La Perouse ,, Sakhalin and Yesso.
Corea ,, Corea and Japan.
Hainan ,, Hainan and mainland.
Malacca ,, Malay Peninsula and Sumatra.
Sunda ,, Sumatra and Java.
Macassar ,, Borneo and Celebes.
Palk ,, Ceylon and India.
Ormuz ,, Arabia and Persia.
Babelmandeb between Arabia and Africa.

5. *Elevation.*—Asia falls naturally into three divisions: (*a*) The northern slope, (*b*) the central tablelands, and (*c*) the southern peninsulas. The most remarkable feature is undoubtedly the enormous extent of elevated tablelands—Pamir Plateau, Table Land of Tibet, Desert of Gobi or Shamo, the Iranian Plateau, Arabia and Armenian Plateaux. The first two have an average elevation of over 15,000 feet. The *mountains* radiate from the Hindoo Koosh in the following lines:—
(1) Thian Shan, Altai, Yablonoi, Stanovoi. Direction N.E.
(2) Kuen Lun, Peling. East.
(3) Himalayas and Nanling. S. East.
(4) Suliman mountains. S.W.
(5) Elburz, Caucasus, and Taurus. West.

The Rivers.—
(*a*) Arctic—Obi (with Tobol, Ischim, and Irtish), Yenesei (Angara and Tunguska), and Lena.
(*b*) Pacific—Amoor, Hoangho, Yang-tse-Kiang, Si Kiang (or Canton), Mekong, and Menam.
(*c*) Indian—Salwen, Irrawaddy, Brahmapootra, Ganges, Indus, Euphrates, and Tigris.
(*d*) *Inland.*—Ili into Lake Balkash.
Tarim into Lob Nor.
Amu Daria and Syr Daria into Sea of Aral.
Helmund into Lake Seistan.

6. *Climate.*—This depending upon general configuration of the continent falls into three divisions:—
(*a*) The Arctic Slope—away from sun, intensely cold winters and very hot summers, small rainfall.
(*b*) Central Tablelands—Dry and subject to extremes.
(*c*) South and West—Sub-tropical, generally abundant rainfall, the heaviest rainfall known being at the Chirrapoongee Hills in Assam.

The climate of the South-East depends to a large extent upon the Monsoons—periodical winds which blow across the India Ocean and China Sea. The great heat over the central tablelands in summer causes the S.W. monsoon to set from cooler regions south of the Equator. This wind is the rain bringer, and its commencement in May or June is always accompanied by a tremendous downpour. In the northern winter, the heat of Africa causes a wind from Asia, the N.E. monsoon, which (to Asia) is dry. The change of the monsoons causes the Typhoons of the eastern seas.

7. *Fauna and Flora.*—These depend upon climate, and are arranged in sections corresponding with the three belts:—
(*a*) Animal—Bear, wolf, fox, sable, ermine, marten, otter, beaver, reindeer, elk, and stag.
Vegetable—Willows, birches, larch, poplar, pine, wheat, barley, oats, rye, etc.
(*b*) Animal—Horse, donkey, camel, yak, antelope, roebuck.
Vegetable—Grass, some wheat, rice, and maize.
(*c*) Animal—Elephant, tiger, leopard, panther, lynx, ourang outang, tapir, rhinoceros, hyæna, jackal, wolf, fox, bear. Reptiles—Such as python, cobra. Birds—Parrots, peacocks, golden pheasant, birds of paradise, etc.
Vegetable—Rice, tea, sugar, coffee, spices, sago, gutta percha, indigo, maize, poppy, teak, maize, millet, bamboo, cotton, palms, banyan, etc.

8. Minerals—Abundant:—
Gold in India, Altai Mountains, Japan and China.
Silver in the Urals and Altai, Japan, China, and Annam.
Platinum in the Urals and Siberia.
Mercury in Japan, India, and China.
Iron in Siberia, India, Persia, Turkey.
Coal in India, China, East Indies.
Tin in Tenasserim, Borneo, and Burmah.
Copper in India, Japan, Siberia.
Salt in India.
Diamonds, India and Borneo.
Rubies, India and Burmah.
And many other precious stones in various parts.

9. Draw a map and insert all names, etc., and go over till the position of each is thoroughly known.

F.—*History.*

Prepare the reign of James I., 1603–1625.
Chief points:—

1. *His right to the throne.* Learn carefully a genealogical table to show this, and also his relationship with Lady Arabella Stuart.

2. *The Stuart opinions.* These are very important as affecting to a large extent the trend of events for the next century. James was, as his tutor styled him, 'the wisest fool in Christendom'; that is, he had a vast amount of book-learning, but very little common sense. When he came to England he had no idea of the English character. He had assumed a belief which he was careful to expound at any opportunity, and which is best known as the 'Divine Right'—*A deo rex, a rege lex*, that is, the king is created by God and is responsible to Him alone; and the law comes from the king. This doctrine of absolute monarchy (or of 'passive obedience' on the part of the people) was not confined to civil matters, but was extended to religious affairs.

The three great sects—English Church, Catholics, and Puritans—all expected great help from James; the Catholics, because his mother was a Catholic, the Puritans because he came from a Presbyterian country. But James was only too glad to shake off the yoke he had to bear in Scotland, and assume an absolute superiority in all questions of church government. He favoured the Established Church. 'No bishop no king' was his answer to those who attacked the prelacy. He was too much of a coward to put this Divine Right into practice, but it cost Charles I. his head.

3. *Lady Arabella Stuart Plot.* Devised by Raleigh, who was imprisoned 13 years for it and was afterwards executed.

4. *Hampton Court Conference.*
Cause—The Millenary Petition of a thousand Puritan ministers.
History—Conference between leading men of Puritans and Episcopalians at Hampton Court, 1604. James took the chair and the greater share of the speaking. Abstruse argument was his strong point, and he enjoyed the opportunity of airing his knowledge.
Results—(1) A new translation of the Bible which appeared in 1611.
(2) Some minor changes in the Prayer Book.

5. *Gunpowder Plot.* Caused by the harsh manner in which James treated the Catholics. The result of the Plot was to deprive Catholics of nearly all their civil rights.

6. *The Plantation of Ulster.* After the rebellion of the Earls of Tyrone and Tyrconnell their lands were forfeited, and so the greater part of Ulster fell into the king's hands. He conceived the idea of granting these lands to English and Scotch settlers on certain conditions (such as building a strong stone house, etc.) which would ensure the peace of the country. Ulster was thus successfully planted, with the result of ultimately making Ulster the most prosperous and peaceful part of the island, and of effectually destroying the trust of the Irish in English justice. To raise funds, James invented the title of Baronet, which he sold for £1,080.

7. *James and his parliaments.* James ruled as far as he could without a parliament, raising money by unjust and illegal means, but the growing power of parliament was abundantly shown by their claim for freedom of speech, and by their successful attack upon Lord Bacon.

8. *Favourites.* (1) Robert Carr, Earl of Somerset, disgraced and died in poverty.
(2) George Villiers, Duke of Buckingham, a life of whom must be prepared.

9. 1622. First newspaper started—*The Weekly News.*
1620. The Pilgrim Fathers land in America.

G.—*Euclid.*

Second Year.—Book I., Propositions 25 and 26, with two deductions per week.

Third Year.—Book I., Propositions 1–12, with two deductions per week.

H.—*Algebra.*

Third Year.—'Scholarship Algebra.' Read carefully Chapters XVIII. and XIX., and work examples thereon. Note especially the *proof* of the rules for the Multiplication and Division of Fractions.

I.—*Teaching.*

Second Year.—The Compound Rules, Weights and Measures. The point most commonly asked about is the finding of the real remainder when a number is divided by several factors and there are several remainders. For example, if a number is divided successively by 8, 9, and 10, and the remainders are 7, 6, 9, what is the real remainder? This is readily seen if the question is arranged thus :—

8) _____ + 7 = 7
9) _____ + 6 = 48
10) _____ + 9 = 648
703

The 7 remains from the units line and is therefore 7 units.
The 6 ,, ,, 8's ,, ,, 48 ,,
The 9 ,, ,, 72's ,, ,, 648 ,,

Third Year.—'Scholarship School Management,' Chapter XII. on Notes of Lessons, which should be very carefully studied.

Test Questions.

1. *Penmanship.*—Write as specimens of—
(*a*) Large-hand :—Syllogism, Unification, Verisimilitude, William Wycherley.
(*b*) Small-hand :—
Cold is Cadwallo's tongue.
That hushed the stormy main.
(This subject requires the greatest care and attention. It is universally weak, and this necessarily entails loss of marks on all written papers.)

2. Write an essay each week, selecting from the following :—
Money—Cleanliness—A description of any historical town or ruin near you—Books—Migratory Birds—The Blessings of Hope.

3. *Notes of Lessons.*
First Year Pupil Teachers should write outline notes ; Second and Third Year Pupil Teachers full notes :—
(1) An Egg ; (2) Habits of Birds ; (3) The Moon ; (4) Latitude and Longitude ; (5) Simple Subtraction ; (6) The Climate of England ; (7) Relative Pronouns ; (8) Common Woods ; (9) A Bell ; (10) A Fountain.

4. *First Year.*
English.—(*a*) Give the past tense and past participle of the following verbs :—*Lead, teach, fly, sit, lay, rise, lie.*
(*b*) Show the meaning and use of the suffix in the following words, and give examples of words similarly formed :—*Womanhood, Darkness, Position, Lovely, Despotism, Movement, Clairvant.*
(*c*) Adjectives are sometimes classified as those of *quantity* and those of *quality*. Explain the distinction and give some examples of both.
(*d*) What are the plurals of *phenomenon, species, axis, syllabus, ox,* and *sheep?* Why are their plurals so formed? Give examples of words that have no singular form.
(*e*) Analyse the following passages, and parse the words in italics :—
(i.) A mist *was driving* down the British *Channel*,
The day was just begun,
And through the window pane, on floor and panel,
Streamed the red autumn sun.
It glanced on flowing flag and rippling pennon
And the white *sails* of ships,
And from the *frowning* ramparts the black cannon
Hailed it with feverish lips.
(ii.) *Dear is* my little native *vale ;*
The ringdove builds and *murmurs there ;*
Close to my cot she *tells her* tale
To every *passing* villager.
The squirrel leaps from tree to tree,
And shells his nuts at *liberty.*
(iii.) *Alas!* they had *been friends* in youth,
But *whispering* tongues *can poison* truth,
And constancy dwells in realms *above,*
And life is *thorny* and youth is vain.
(iv.) The rampart is won and the spoil *begun,*
And *all but* the after carnage done ;
Desperate groups of twelve or *ten*
Make a pause and turn again,
With *landed* backs against the wall
Fiercely stand or *fighting fall.*

Music.—(i.) State which tones of the scale have above them (*a*) major thirds ; (*b*) minor sevenths.
(ii.) Re-write the following in two-pulse measure, halving the value of each note and rest :—

| d : — | — : m | s : — | : f | m : — | : ‖

(iii.) What are the mental effects of the following sounds when sung slowly?—*me, fah, te, lah, doh.*

5. *Second Year.*
English.—(*a*) Define adjective, and show how an adjective may be replaced by a phrase or a sentence.
(*b*) Distinguish moods and tenses, with examples.
(*c*) What do you know about the prefixes and suffixes of the following words?—*Recur, suffer, lotion, society, preclude, direct, visible.*
(*d*) How does a relative pronoun differ from other pronouns? Give examples.
(*e*) Paraphrase and analyse the following passages, and parse words in italics :—
(i.) Merciful *heaven,*
Thou rather with thy sharp and sulphurous bolt
Splitst the unwedgeable and gnarled oak
Than the soft myrtle ; but man, proud man,
Drest in a little brief authority,
Plays *such* fantastic tricks before high heaven
As make the angels weep ; who with our spleens
Would *all themselves laugh mortal.*
(ii.) *How* beautiful is night!
A dewy freshness fills the silent air,
No mist obscures, nor cloud, nor speck, *nor stain*
Breaks the serene of heaven.
In full-orbed glory yonder moon divine
Rolls through the dark blue depths.
Beneath her steady ray
The desert circle spreads
Like the round *ocean, girdled* with the sky.
How beautiful is night!
(iii.) Not *wholly* in the busy world, nor quite
Beyond it, blooms the garden *that* I love.
News of the humming city comes to it
In sound of funeral or of marriage bells ;
And *sitting* muffled in dark leaves you hear
The windy clanging of the minster clock,
Although between it and the garden lies
A league of grass, *washed* by a slow broad stream,
That, *stirred* with languid pulses of the oar,
Waves all its lazy lilies, and creeps *on*
Barge-laden to three arches of a bridge
Crowned with the minster tower.

Music.—(i.) Re-write the following passage, making a change by a bridge note to the first sharp key at (*a*), and a return to the original key at (*b*) :—

Key C. (*a*) (*b*)
m f r d s fe l m fe l r fe s f m r d

(ii.) Name the intervals :—*ray-doh*[1], *lah-soh*[1], *soh-ray*[1], *me-doh*[1], *te-lah.*
(iii.) Write out the following passage in four-pulse measure, beginning on a strong pulse. The figures show duration in pulses or fractions of a pulse :—

1	3/4	1/4	1 1/2	1/2	3/4	1/4	3/4	1/2	1/2	1/4	1/4	1
d	m	f	s	REST	s	f	m	REST	REST	r	d	

Teaching.—(i.) What use would you make of the Ball Frame or other apparatus in teaching Notation?
(ii.) What points have to be considered in choosing a reading book for school use?
(iii.) What are the two methods of teaching subtraction? Work an example to illustrate your answer.

6. *Third Year.*
English.—(*a*) What do you mean by verbs of incomplete predication? Give an example, and analyse the sentence which contains it.
(*b*) If you were explaining the following line to a class, what should you say about the words printed in italics?
Seats beneath the shade
For talking *age* and whispering *lovers* made.

(*c*) What is meant by 'comparison of adjectives'? Give instances of irregular forms.

(*d*) Give examples of Latin words which came into English, (1) through French, and (2) direct.

(*e*) Paraphrase and analyse the following, and parse words in italics :—

(i.) New-born flocks in *rustic* dance,
Frisking, ply their feeble feet.
Forgetful of their wintry *trance*,
The birds his presence greet.
But chief the skylark *warbles* high
His trembling *thrilling ecstasy*,
And *lessening* from the dazzled sight
Melts into air and *liquid* light.

(ii.) *Thou first* and chief, sole sovran of the vale!
Oh, struggling with the darkness *all* the night,
And visited all night by troops of stars,
Or when they climb the sky or when they sink,
Companion of the morning star at dawn,
Thyself earth's rosy *star*, and of the dawn
Co-herald, wake, oh, *wake*, and utter praise.
Who sank thy sunless pillars *deep* in earth?
Who filled thy countenance with rosy light?
(Hymn to Mont Blanc.)

Music.—(i.) Name the following intervals :—*doh-se*, *se-doh*^{1}, *fah-se*, *se$_1$-fah*.

(ii.) Which of the following is highest and which lowest in pitch?—*fah* in key G, *me* in key B flat, *soh* in key D, *te$_1$* in key C, *me$_1$* in key A flat.

(iii.) Write the following in four-pulse measure, beginning on a strong pulse. The figures show duration in pulses or fractions of a pulse :—

$2\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
m	**f**	**s**	REST	**l**	**s**	**f**	**m**	**f**	**t$_1$**	**d**	REST

Teaching.—(i.) What is the work in Arithmetic for the second and sixth standards?

(ii.) What is the use of a school library? Give 20 examples of suitable books.

(iii.) Draw out a scheme of Home Lessons for Standard V. for a week. When and how would you correct them?

7. *Geography.*

(i.) Describe a coasting voyage from Genoa to Naples.

(ii.) Give some account of the chief cities in the Plain of Lombardy.

(iii.) Write a description of three of the most famous buildings or ruins in Rome.

8. *History.*

(i.) Who were the chief navigators of the Tudor Period? What object had their voyages, and what were the chief results?

(ii.) What were the results of the defeat of the Spanish Armada?

(iii.) Give some account of the social life of rich and poor in the reign of Elizabeth.

9. *Third Year.*—(*Boys.*)

(i.) Divide $x^4 + x^2y^2 + y^4$ by $y^2 + x^2 - xy$.
Ans. $x^2 + y^2 + xy$.

(ii.) Find the H.C.F. of
(*a*) $4a^4 - 5a^2 + 1$ and $4a^3 + 12a^2 - a - 3$.
Ans. $4a^2 - 1$.
(*b*) $x^3 - 4a^2 + 12a - 9$ and $x^2 + 2x - 4a^2 + 8a - 3$.
Ans. $x - 2a + 3$.

(iii.) Simplify $\dfrac{a^3 + b^3}{ab(b^2 - a^2)} - \dfrac{b}{a^2 + ab} + \dfrac{a}{ab - b^2}$.
Ans. $\dfrac{1}{a + b}$.

SCHOLARSHIP COURSE.

WORK FOR THE MONTH.

1. *Reading and Penmanship.*—Ten minutes' practice each per day, which must not be neglected.

2. *Spelling.*—Learn 50 words per week from 'Words Commonly Misspelt' or any good list. Test about once a week by writing a passage from standard author.

3. *Composition.*—A very important subject, needing the greatest care in all written work. See note last month. Draw up each essay on a definite plan.

Write one or two essays each week, selecting from the following subjects :—

1. Insect life.
2. The pleasures and uses of a garden.
3. Bicycles and tricycles.
4. The use and abuse of stimulants.
5. Solitude.
6. The advantages of a good memory.
7. An April day.
8. Westminster Abbey and its associations.
9. Lifeboats and their services.
10. Second thoughts are best.

An essay should occasionally be sent up for criticism.

4. *English.*

(*a*) Learn 50 roots and meanings per week.

(*b*) *The Pronoun.*—Learn a good and complete classification with definitions.

Points to notice :—

(1) *Ye*, properly nominative case. *You*, usually used in addressing single persons, and followed, of course, by a plural verb. *Its* is comparatively modern; the proper form—etymologically—is *his*.

(2) Distinguish clearly between Emphatic and Reflexive Pronouns. The Simple Reflexions are often mistaken—*e.g.*, I sat *me* down = I sat *myself* down.

(3) Note the Reciprocals *each other*, *one another*.

(4) Notice the adjectival and adverbial use of *what*—*e.g.*, 'Two such I saw, *what* time the laboured ox,' and '*What* with the noise and confusion I was bewildered.'

As as a relative after *such*, *same*, *as many*, *as much*, etc.

(5) Distinguish the meanings of *each* and *other*, *some* and *several*, *another* and *the other*, etc.

(*c*) *Literature.*—Chap. V., Meiklejohn's 'Outlines of English Literature.' Raleigh, Bacon, Shakespeare, Milton, Butler, Dryden, Taylor, Hobbes, Bunyan, and Locke.

Prepare brief lives of the above, with summaries of their chief works.

5. *Arithmetic.*

Boys.—Lock, Exs. CXXXII.–CXXXV. Profit and Loss. Averages and Stocks.

If there is not sufficient time to work all the examples given, select those that present any difficulty. Be sure in profit and loss sums to always calculate on the *cost* price. There is no difficulty in averages. In stocks, the difference between *stocks* and *cash* must be carefully noted.

Girls.—Dixon & Beach. Work Ex. XXXI.—General examples on Interest.

Be most careful to state and explain the sums clearly and methodically. This is of first importance in the paper, and carries many marks.

6. *Algebra.*

Boys.—'Scholarship Algebra.' Read carefully Chaps. XX., XXI., and XXII., and work all examples. The explanations in Chap. XXII. are very clear, and should be most carefully studied.

Girls.—'Scholarship Algebra.' Read Chap. VI., and work examples on it.

7. *Euclid.*—Book II., Props. 10–12, and 4 deductions per week.

Practise writing out the propositions against time, not using the letters A to G.

8. *Geography.*—AUSTRALIA. Physical features, climate, and productions.

Chief points.—Note regular coast unbroken by any large opening, mountains generally round the coast, and the results—a well-watered strip along the coast with numerous small rivers, a comparatively dry interior, shallow salt lakes, barren land unfit for habitation.

Difficulties to explorers :—(*a*) The mountain barriers; (*b*) The absence of navigable rivers or arms of the sea; (*c*) The absence of fresh water; (*d*) The impenetrable character of the dense bush; (*e*) The hostility of the natives; (*f*) The intense heat; (*g*) The absence of all natural foods; (*h*) The difficulties of transport: horses, donkeys, and mules useless; camels only mode of conveying supplies.

The Great Barrier Reef, over a thousand miles long, sixty to one hundred and twenty miles from the coast.

Productions (*Vegetable*).—Note the remarkable absence of all natural foodstuff plants; the enormous forests of eucalypti; the blue, red, white, and stringy bark gum trees, some of them over 400 feet high—one found towering 120 feet higher than the top of St. Paul's; the splendid jarrah wood; the flame tree; the gigantic ferns; the peculiar arrangement of the leaves.

The wonderful growth of plants which have been introduced should be noted. Thistles growing 16 feet high; watercress

choking up rivers, etc. The apricots in Queensland, Tasmanian apples, etc. The enormous crops of wheat, maize, oats, and barley; the coffee, sugar, and oranges of Queensland.

Animals.—The native fauna distinctly peculiar; no large quadrupeds; many varieties of the marsupials, or pouched animals. Note, dingo or wild dog, platypus or duck-billed watermole. Birds:—Emu, laughing jackass, bower bird, lyre bird, pigeons, etc. Many poisonous snakes.

Imported animals have done well. Sheep (of which there were nearly 100 millions in 1894), cattle, pigs, and horses numerous in all parts.

Minerals.—Very important; valuable deposits everywhere. Tabulate in note-book and learn places where found. Note the new Coolgardie District of West Australia.

NEW SOUTH WALES received its name from its first explorer, Capt. Cook, 1770. Became a penal settlement in January 1788. Capt. Phillip landed 750 persons on the site of the present town of Sydney. Responsible Government was established 1856, and vested in a Governor appointed by the Crown—a Legislative Council of 69 members and a Legislative Assembly of 125 members paid £300 per annum—manhood suffrage. Population, 1,251,450.

Productions:—

Animal—At the end of 1894 there were ½ million horses, 2½ million cattle, 57 million sheep, ¾ million pigs. 361 million pounds of wool, worth £9,000,000, were produced.

Minerals—Gold (amount for 1894 = £41,000,000), coals, copper, silver, tin, iron, antimony, asbestos, cinnabar, kerosene shale, small quantities of diamonds, rubies, opals.

Vegetable—Wheat, maize, and other grains, tobacco, sugar cane, wine, oranges, and every kind of fruit.

Exports.—£20,000,000 per annum.

Imports.—£15,000,000.

Towns:—

Sydney.—Capital, on Port Jackson, pop. 423,000. Contains Government Buildings, Mint, University, National Art Gallery, Free Public Library, Observatory, two Cathedrals, etc.

Newcastle (13,500), Broken Hill (19,100; famous silver mines), Bathurst (10,000), Goulbourn (12,000), Paramatta (12,000), Maitland (10,000), Grafton, Albury, and Tamworth.

Dependencies.—Norfolk Island, pop. 750.
Lord Howe Island, pop. 55.

VICTORIA, originally part of N. S. Wales (known as Port Phillip District), made a separate colony in 1851. One of the youngest, the smallest, most populous, and most wealthy colony. Area, 87,884 sq. miles. Population (1895), 1,180,043.

Productions:—

Gold, £238,000,000 since 1851.

Tin, copper, antimony.

Chief Exports in 1894—Wool (£4742,000), gold (£3,700,000), wheat, flour, and biscuit (£961,000), livestock (£282,000), preserved and frozen meats (£170,000), butter (£898,000), wine.

Chief Imports.—Sugar, molasses, woollen goods, timber, and manufactured goods.

Towns:—

Melbourne.—Chief city; University, Museum, Mint, Public Gardens, Observatory, Public Library, Hospitals. Population, 438,955.

Ballarat and Bendigo (Sandhurst), Geelong, Castlemaine, Warrnambool, and Stawell.

Government:

(*a*) Governor appointed by Crown, and Executive Ministry of 10.
(*b*) Legislative Council of 48.
(*c*) Legislative Assembly of 84.

(Prepare a good map; insert all physical features and names of places to be remembered.)

9. *History.*—Edward III., Richard II., and Henry IV.

Edward III.—Chief points:—

1327–1330.—The rule of Isabella and Mortimer.

1329.—*Renewal of Scotch War.* Defeat of Scots at Halidon Hill.

1337.—*The Hundred Years' War.*

Causes:—(*a*) The support given by Philip VI. to David Bruce.
(*b*) The jealousy of French and English sailors.
(*c*) The attempt by Philip to seize Aquitaine.
(*d*) The support given by France to the Court of Flanders against the rising power of the *wool towns.* As England supplied Flanders with the raw material, the domination of France would have seriously affected the export of wool—the staple product.
(*e*) Edward's claim to the French Throne can hardly be taken seriously, since if the principle he asserted were recognised, *i.e.* that a woman could transmit right, there were many who stood before Edward. The claim was probably made to secure the adherence of doubtful vassals of France.

Events:—Crecy and Neville's Cross, 1346. Capture of Calais, 1347. Poitiers, 1856. Treaty of Bretigny, 1360. Plans and details of Crecy and Poitiers must be learnt.

Results:—A historical enmity of France and England.
A continual alliance of French and Scots.

1349.—*The Black Death*, a species of Cholera.

Results:—(*a*) The population reduced one-half.
(*b*) The rate of labour wages doubled.
(*c*) The beginning of the sytem of 'letting' lands at a fixed rent.
(*d*) The Statutes of Labourers, 1349–1351.
(*e*) Great mortality among sheep.

1376—The Good Parliament, the work of which was undone by John of Gaunt.

Important Statutes:—

1351.—*First Statute of Provisors* against the right of Popes to present aliens to English benefices.

1352.—*Statute of Treasons.* As the lands of persons convicted of treason reverted to the Kings, it was their interest to stretch the term as widely as possible. This Statute limited it to certain defined acts, such as:—

1. Plotting the death of King, Queen, or Prince of Wales.
2. Levying war on the King.
3. Counterfeiting the Great Seal and forging money.
4. Killing Chancellor, Treasurer, or Judges while executing their duties.

1353.—*Premunire* (*First*) against foreign jurisdiction, generally.

Statute of Staples—appointment of staple towns to facilitate collection of revenue.

1365.—*Premunire* (*Second*) against the Papal power in particular.

Richard II.—

The misgovernment in the years of minority.

1381.—*The Peasant's Revolt*, caused by—
The effect of the Statutes of Labourers.
The revival of villenage.
The discontent at the conduct of French affairs.
The unjust poll tax.
The socialistic teaching of Wycliffe's 'Poor Preachers.'
(Note that it was general in England. Wat Tyler's best known because most successful.)

Results:—The general decay of villenage.
Harsh laws against the poor.
Religious reaction.

The Lords Appellant and the Merciless Parliament.

The absolute rule of the King and his subsequent downfall.

Statutes:—

1390.—*Provisors* (*Third*).

1393.—*Premunire Facias* against the power of the Pope.

(Note.—This is one of the great acts leading up to the severance of the English Church from Rome.

Henry IV.—

The first of the Lancastrian Kings. Prepare a genealogical table showing his claim.

French aid to Scots (defeated at Homildon Hill) and to Welsh.

Revolts against the King:—

1. Earls of Huntingdon, Kent, and Salisbury.
1. Wales under Owen Glyndwr; joined by the Percies; Battle of Shrewsbury.
3. Percy, Northumberland, and Scrope; execution of the latter 1407.
4. Earl of Northumberland; defeat and death at Bramham Moor, 1408.

Statutes.—*De Heretico Comburendo* directed against the Lollards, an account of whom must be prepared.

10. *School Management.*

'Scholarship School Management,' Chap. IV., The Teaching of Reading. Test preparation by means of the questions at end of book.

11. *Domestic Economy.*

Clothing: Uses, raw materials from which made, names of various fabrics, cost and durability, relative value. Abuses in dress.

12. *Music.*—Chromatic names, relative pitch of keys and notes. (The practical work must not be neglected. Get Curwen's 'Practical Music for Pupil Teachers' and practise.

13. *French.*—Next five pages of 'Le Trésor.' The regular conjugations and the exceptions to them.

QUESTIONS TO BE ANSWERED.

1. *Penmanship.*—Write as specimens of—
(*a*) Largehand :—Jurisprudence, Kleptomania, Llewellyn.
(*b*) Smallhand :—

'Tis morn, but scarce yon level sun
Can pierce the war clouds rolling dun.'

2. Analyse the following passages, and parse the words in italics :—

(i.) In misery's *darkest* cavern *known*,
His useful care was *ever nigh*,
Where hopeless anguish poured his groan,
And lonely want retired *to die*.
His virtues *walked* their narrow *round*,
Nor made a pause nor left a void,
And *sure* the Eternal Master found
The single talent *well employed*.

(ii.) Oh ! *what avail* the largest gifts of Heaven
When drooping health and spirits go *amiss*,
How tasteless then *whatever* can be given !
Health is the vital principle of bliss,
And exercise of health. In proof of this,
Behold the wretch who wastes his life *away*
Soon swallowed in disease's sad abyss,
While he whom toil has braced, or manly play,
Has *light as air each* limb, *each thought* as clear as day.

(iii.) *As* in a theatre the eyes of men,
After a well-graced actor leaves the stage,
Are idly bent on him that enters *next*,
Thinking his *prattle* to be tedious.
Even so, or with much more contempt, men's eyes
Did scowl on Richard ; no man cried 'God *save* him !'
No joyful tongue gave *him* his welcome *home*.

3. What is the Subjunctive Mood? Explain its uses?

4. Distinguish Participles and Gerunds, giving examples of each.

5. The Active Gerundial Infinitive has sometimes a passive use. Explain this and give instances.

6. Write full notes of lessons on the following subjects :—
(*a*) The commercial value of the Rhine; (*b*) The Black Prince; (*c*) Simple Interest ; (*d*) Sugar.

7. (*Boys.*)

(*a*) Simplify (i) $\frac{2}{a+2x} - \frac{1}{a-2x} + \frac{x(3a+2x)}{a(a^2-4x^2)}$.

Ans. $\frac{a-x}{a(a+2x)}$.

(ii.) $\left(\frac{x}{y}-\frac{y}{x}\right) + \left(\frac{1}{x-y}-\frac{1}{x+y}\right)$.

Ans. $\frac{x^4-2x^2y^2+y^4+2xy^2}{xy(x^2-y^2)}$.

(iii.) $\frac{1}{1+\frac{1}{x-1}} + \frac{1}{1-\frac{1}{x+1}}$. Ans. 2.

(*b*) Simplify (i) $\frac{x}{2(x-1)} - \frac{x+2}{2(x+1)}$. Ans. $\frac{1}{x^2-1}$.

(ii) $\frac{ax-x^2}{(a+x)^2} \times \frac{a^2+ax}{(a-x)^2} \times \frac{a^2-x^2}{ax}$. Ans. 1.

(iii) $\left(\frac{\frac{x}{y}+2}{\frac{x}{y}+1} + \frac{x}{y}\right) \div \left(\frac{x}{y}+2-\frac{\frac{x}{y}}{\frac{x}{y}+1}\right)$.

Ans. 1.

8. (*a*) Give some account of the native races inhabiting India, and the manner in which India is governed.
(*b*) Say what you can about Beluchistan and Burmah.

9. (*a*) What were the chief constitutional measures passed in the reign of Edward I.?
(*b*) Give an account of the Barons' War (Henry III.), and say in what features De Montfort's Parliament differed from those previously called.

10. How should the blackboard be used in Geography? What wall pictures do you consider necessary in a school ?

11. What are the ingredients in a loaf of wheaten bread? What other kinds of bread are there, and why is one to be preferred to another ?

12. What kinds of food are specially useful (1) for maintaining the heat of the body, (2) for forming flesh, and (3) for forming bone? What names are given to these several kinds of food, and why?

13. If the first note of each of the following passages be regarded as *ray*, what will the others become ?

(*a*) l fe s d' n r fe l t d' fe l s
(*b*) s f ta l n f d' ta r' f ta l

CORRESPONDENCE.

1. Individual assistance will be given as far as possible by advice, solution of difficulties in any subjects, model answers, etc.
2. Specimens of Writing, Paraphrasing, Maps, Composition, etc., will be marked and criticised gratis.
3. To assist students in rural districts, Freehand or Model Drawings will be corrected and marked, with hints for improvement, etc., and returned if accompanied by a postage stamp.
4. As a rule, all replies will appear in the Correspondence Column, but anyone desiring an immediate reply may obtain it by enclosing a stamped, addressed envelope.
5. To ensure an answer in the next issue queries must be sent by the 15th of each month.
6. Name and address of sender, with coupon of current number of the PRACTICAL TEACHER, and *nom de plume* if desired, must be enclosed.

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to 'A. T. FLUX, 12, Lower Park Road, Belvedere, Kent.'

ANSWERS TO CORRESPONDENTS.

ADA W.—Essay fairly good, but should be longer—about 40 lines. It should be written upon some definite plan. The writing is decidedly poor. I should advise you to get a good copybook and practise daily. The pen is improperly held, causing an awkward angularity.

3RD YEAR.—You have adopted a very stiff style. The ovals of the letters are too elongated. The small hand is rather large, and should be written without the assistance of guiding lines. Marks 65 per cent. Map.—The outline looks better in black ink. Use a finer pen for printing. Marks 85 per cent.

OAKHAM.—You write a very good essay. Marks 90 per cent. One or two slips in spelling.

OXON.—Penmanship 95 per cent. Map 90 per cent. Freehand very good. Lining is shaky in places. A sure second class—probably first. Essay 85 per cent. 'Niagara,' not 'Niagra.'

E. T. Y.—If c is a measure of a and b, it will also measure $ma \pm nb$.

Let $a = pc$ and $b = qc$.
Then $ma \pm nb = mpc \pm nqc = c(mp \pm nq)$.
Therefore c measures $ma \pm nb$.

QUERY.—No, Ceylon is not under the government of India, but constitutes a Crown colony.

ANSWERED BY POST.—M.S. ; A.L. (Crewe) ; H.A. (Horsham); A. J. T. (Stowmarket); B. N. (Strommess); A. C. McC. (Killen); J.H.T. (Tenby); W.A.A. (Wantage), E.C.; P.D. (Caermarthen); A.F.B. (Oxford); M.L.J. (Lewes); A.L., E.S. (Thirsk); F.G.S. (Winchester); M.A.H. (Brampton); F.D. (Malton); N.G. (Calne); Oxon (Dorset); H.D.T. (Llandilo); A.T. (Milford).

THE OXFORD SHORTHAND.—Teachers using this system will be glad to learn that the publishers (The Oxford Shorthand Co., Dover) are about to issue a new HANDBOOK OF DIAGRAMS for teachers and scholars. The diagrams will be of a convenient size, and effectively printed in white or black, white on blue, black on orange, white on red, and in other combinations of colour. Further additions are being made to the exercises and literature of the system, and teachers, students and educationists who have not yet examined the OXFORD SHORTHAND are recommended to apply to the publishers. The publications, we believe, are issued and sold at remarkably cheap rates. It is said that the amount spent in providing the 'Oxford Shorthand' and bringing it into its present position now approaches £3,000.

OUR 1896 CERTIFICATE CLASS.

BY J. C. HOROBIN, M.A.,
Principal, Cavendish College, Cambridge.

FIRST YEAR—MEN.

Reading, etc.

See November number.

Penmanship.

Write in text hand and small hand :—

'The vicissitudes of life are the test of true greatness.'

Spelling.

Write from dictation :—

The migration of birds | is governed by certain intelligible laws, | but it varies | in many of its details, | even in the same species, | according to changed conditions. | It may be considered | as an exaggeration of a habit | common to all locomotive animals, | of moving about in search of food. | This habit is greatly restricted | in quadrupeds | by their inability to cross the sea, | or even to pass through | highly cultivated valleys. | As they travel by night | at a considerable height, | their movements are difficult to observe, | and are supposed to be more mysterious | than they perhaps are. | In the tropics | birds move about to different districts | according as certain fruits ripen, | or certain insects become abundant.

School Management.

1. What is meant by a sense-impression and by a concept? Describe the process by which we are said to *perceive* an object.

2. What is meant by intuition, and by intuitive methods of teaching? Give some examples.

3. Which of the manual employments devised by Froebel is most helpful in teaching children the elements of Arithmetic? Give examples of a lesson on number suited for infants.

4. What are the advantages and disadvantages of setting scholars in a class to question one another at the end of a lesson?

5. It is set forth in the Official Instructions to Inspectors that, 'From the first the teaching of English should be supplemented by simple exercises in Composition.' Explain, in detail, how you would give effect to this injunction in Standards II. and III.

6. What fundamental differences in discipline do you distinguish in infant schools and schools for older children?

Composition.

Write a short essay on :—

(*a*) Arbitration as a means of settling international disputes.

(*b*) State pensions.

(*c*) The distinction between wit and humour.

Music.

1. State the major scale relation (as subdominant, etc.) of the following tones :—(1) s (2) d' (3) f (4) r (5) t.

2. Fill up two measures of each of the following kinds, showing rests and continuations in each example :—(1) two-pulse ; (2) four-pulse; (3) three-pulse.

3. Write in figures over the following the value (as 1 pulse, ½ pulse, 1½, etc.) of each note and rest :—

| s : — | -.f :m.,f | s :-.l | r. : .m ‖
| f,s.l : s.d | r :d ‖

4. Write the time names (as *taa*, or *taa-tai*, etc.) of the following pulses :—

(1) | 1.,1 :1 ‖ (2) | 1 :1.1 ‖ (3) | :1 ‖
(4) | 1 :-.1 ‖ (5) | 1,1.1 : 1.1,1 ‖

5. Re-write the following in four-pulse measure, doubling the value of each note and rest :—

(1) | s.,f :m.d | (2) | r :-.m | (3) | f,s.l,t :d'.s |
(4) | m . : .f | (5) | m,r.d :r.,d | (6) | d : — ‖

6. Give the words that express the opposite of—*Diminuendo, Piano, Staccato, Accelerando.*

Geography.

1. Draw maps of :—
   (*a*) Hindostan, north of a line joining Bombay and Calcutta.
   (*b*) Western Australia.
   (*c*) South Island.

2. Where and for what famous are :—Barrow-in-Furness, Cork, Oban, Peterhead, Cromer, Hurst Castle, Aberystwith, Hartlepool, Tilbury, Spithead, Berehaven?

3. What do you know about the Sikhs, Maories, Hottentots, Zulus, Tamils, Houssas, Dingoes?

4. Draw a sketch map of the Ganges basin.

5. Show on a Mercator chart the telegraphic communication from London to the capitals of the different portions of the Empire.

English.

1. Comment on the following estimate of Gray :—
   'A poetic talent distinguished, rare but stinted.'

2. Annotate :—Pothooks, whisk, hoops, muses, dogs-ears, imbroglio, My Lady, Capucine, Melissa.

3. Analyse 'Bard,' III. 3, first ten lines.

4. Comment on Symphony, fugues, descant, besides the flourishing studies.

5. Analyse page 17, lines 12–19.

6. How far did Milton give expression to personal views or to those of his party on educational matters?

History.

1. What do you know of Howard, Swift, Gainsborough, Milton?

2. State clearly the grounds on which Henry II., Henry VII., William III., and George I. came to the throne.

3. What was the cause of the dispute between Henry II. and Becket, John and the Pope, Edward I. and the Clergy.
What persecuting acts were passed in the reigns of Charles II. and Anne, and when were they repealed?

4. Sketch the condition of Ireland during the reign of Elizabeth.

5. What changes in the industrial condition of the people took place in the Tudor period?

6. In what way may Henry VII.'s reign be regarded as the beginning of modern history?

Arithmetic.

1. Divide £180 among A, B, and C, so that A may receive three times as much as B, and B and C together may receive half as much as A.

2. Assume that four English navvies can do as much work in a day as 5 French navvies, and that 4 French navvies can do as much as 7 negroes. It is found that 13 English and 12 French do a piece of work in 3 days. How long will it take 10 negroes? Express your result decimally to three significant figures, and use none but arithmetical symbols in your work.

3. A can dig a certain length of ditch in 3 days, B can do the same in 4 days, and C in 5 days. How long will it take the three persons, A, B, and C, together, to dig the same length of ditch? What proportion of the length is dug by each?

4. An excursion train, a quarter of a mile long, leaves a station at 8 hours 22 mins., and travels at the rate of 40 miles an hour ; the ordinary train, which travels at the rate of 66 feet per second, leaves the station at 8 hours 26 mins., and follows the other. How soon afterwards may a collision be expected?

5. A set off from London to York, and B at the same time from York to London; they travel uniformly. A reaches York in 16 hours, and B in 36 hours after they met on the road. Find in what time each has performed the journey?

6. A can beat B by 5 yards in a 100 yards race, and B can beat C by 10 yards in a 200 yards race. By how much can A beat C in a 400 yards race?

Algebra.

1. (*a*) Prove that the cube of the sum of any two quantities exceeds the sum of the cubes by three times their product multiplied by their sum.

(*b*) Find the value of :—

$$\frac{x^2+2xy+y^2-z^2}{x^2+2xz-y^2+z^2} \text{ when } x=3,\ y=2,\ z=1.$$

2. Resolve into elementary factors:—

(*a*) a^4-b^4.
(*b*) $15x^2+x-84$.
(*c*) $x^2-3x-130$.

3. Find the G.C.M. of $6a^4+5a^3b-10a^2b^2+7ab^3-2b^4$ and $12a^5+7a^4b+3a^3b^2-4a^2b^3+5ab^4-b^5$.

4. Simplify :—

$$(a)\ \{(a^{\frac{2}{3}}a^{\frac{1}{2}}\div a^{\frac{1}{6}})^2\}^3$$

$$(b)\ \frac{x^2-16y^2}{x^2-xy-12y^2}\times\frac{x^2-9y^2}{x^2+xy-12y^2}\cdot$$

$$\frac{a-7a^{\frac{1}{2}}}{a-5\sqrt{a}-14}\div\left(1+\frac{2}{\sqrt{a}}\right)^{-1}.$$

5. Simplify $\sqrt[3]{135}-\frac{1}{3}\sqrt[3]{320}+\frac{1}{2}\sqrt[3]{1080}$.

6. Solve the equations:—

$$(a)\ \frac{60-x}{14}-\frac{3x-5}{7}=6-\frac{24-3x}{4}.$$

$$(b)\ \sqrt{x+a}-\sqrt{x-a}=\sqrt{x}.$$

$$(c)\quad \begin{aligned} x+y&=x\\ 15x^2-34xy+15y^2&=0. \end{aligned}$$

7. Find the p term and the sum of p terms of an A.P. of which the first term is a, and the common difference b. In an A.P. of $2n+1$ terms the sum of the odd terms $=\frac{n+1}{n}$ times the sum of the even term.

8. On a road the number of telegraph posts per mile is such that if there were one fewer in each mile, the interval between the posts would be increased by $2\frac{14}{15}$ yards. Find the number of posts per mile.

Euclid.

1. Prove I. 27. The parts of all perpendiculars to two parallel lines intercepted between them are equal.

2. Prove I. 28. Two right lines passing through a point equidistant from two parallels intercept equal portions of the parallels.

3. Prove I. 29. If ACD, BCD be adjacent angles, any parallel to AB will meet the bisectors of these angles in points equally distant from where it meets CD.

4. Prove II. 11. Cut a line externally in extreme and mean ratio.

5. Prove III. 20. If the sum of the squares of two lines be given their sum is a maximum when the lines are equal.

6. Prove III. 22. If a quadrilateral be described about a circle, the angles at the centre subtended by the opposite sides are supplemental.

SECOND YEAR—MEN.

Reading.
Penmanship.
Composition.
Geography.
History.
} As First Year.

Teaching.

See November number.

School Management.

1. Give the rules affecting the attendance of (1) half-timers, (2) children under three years of age, (3) girls belonging to a cookery class held at a distance from the school. How would you indicate (4) removal from the register, (5) re-admission, (6) holidays?

2. From what registers would you collect the information required for obtaining the average attendance, and the number of children qualified for entry on the examination schedule? Calculate the average attendance of a school which has been open during 43 complete weeks of the year, the total number of attendances being 42,482.

3. What processes of thought are required for accurate 'classification'? Say what subjects of school instruction furnish the best discipline in classifying objects, whether mental or physical.

4. Explain and illustrate by examples the difference between the 'converse' and the 'contradictory' of a proposition; and say when and under what conditions the converse of a proposition is or is not necessarily true.

5. What is the exact difference between inductive and deductive reasoning? Give a simple example of each process in connection with some subject of instruction in an elementary school course.

6. Much time is often spent by class teachers in causing words to be spelt aloud, and in repeating, as an oral exercise, the spelling of the same words. Do you think such an exercise either useful or necessary? If not, how can good spelling be taught without it?

7. Discuss the aphorism of Jacotot; 'All human beings are equally capable of learning,' with special reference to class teaching.

Euclid.

1–6. As First Year.

7. Prove IV. 11. Construct a regular pentagon, being given a side.

8. Prove VI. 7. Three concurrent lines from the vertices of a triangle ABC meet the opposite sides in A, B, C, prove AB, BC, CA = AB, BC, CA.

Algebra.

Questions 1–8. As First Year.

1. How can multiplication and division be facilitated by the use of logarithms? Show that a sum of money will be more than doubled in 18 years at 4 per cent. compound interest, having given log 1·04 and log 2.

2. A man whose income is £900 a year, insures his life at the rate of £3 10s. for £100, to such an amount that at his death his heir may receive a sum whose interest at 4 per cent. per annum is equal to the man's reduced income. What annual premium must he pay?

3. Find the number of permutations of n things taken r together. How many different words may be made of the letters of the expression $a^2c^3b^4c$? The number of combinations of n things taken r at a time is the same as the number of them $n-r$ at a time.

4. Assuming the law of formation of the terms to hold when $n-1$ binomial factors are multiplied together, prove it to hold for n factors, and thence derive the Binomial Theorem.

Write down the middle term of $\left(3ax-\frac{y}{3a}\right)^n$

5. Solve the equations (*a*) $\sqrt{4x-3}+2\sqrt{2x-5}=5$.

$$(b)\quad \begin{aligned} x-y&=m,\\ nx+my+y^2&=0. \end{aligned}$$

$$(c)\ \sqrt{\frac{3x}{x+y}}+\sqrt{\frac{x+y}{3x}}=2.$$
$$xy=54+x+y.$$

6. Two passengers have together 600 lbs. of luggage, and are charged for the excess above the weight allowed, 3s. 4d. and 11s. 8d. respectively. If all the luggage had belonged to one of them he would have been charged £1. How much luggage is each passenger allowed free of charge?

Music.

1. Note tests for Division IV. in schools include :—

A simple passage containing a transition of one remove indicated by bridge notes.

Write two passages, one changing to the first sharp key and one changing to the first flat key, of not more than twenty notes each, in accordance with these requirements. Do not write in time.

2. Time tests for Division IV. in schools include :—

One or more series of notes in two-pulse, three-pulse, or four-pulse measure, including pulse-and-a-half-notes; also a SIMPLE *phrase in six-pulse measure, beating twice to the measure.*

Write two passages, one in four-pulse measure and one in six-pulse measure, and four measures each, in accordance with

these requirements. Use no rests shorter than a whole pulse, and no notes shorter than a half-pulse. Write the pulse-signs plainly and boldly, and use '/' for the notes throughout.

3. Transcribe the following passage in two-pulse measure (*i.e.*, write in one pulse what is here in three pulses) :—

s : — :f	m :f :s	l :t :d'	s : — : —
l : — : —	r :m :f	m : — : —	— : — : — ‖

4. State the average compass of Trebles (adults), Altos (adults), Tenors, and Basses.

5. Describe the beating of time of (1) two beats in a measure, (2) three beats in a measure, (3) four beats in a measure.

6. State the meanings of the following terms :—(1) A tempo ; (2) Ad libitum ; (3) Adagio ; (4) Dal Segno ; (5) Grazioso ; (6) Calando.

English.

Gray. As First Year.

Richard II.

1. Annotate as fully as you can—thanks, benevolences, to sue his livery, my sour cross, a woman's war.

2. Distinguish between a simile and a metaphor, with examples.

3. Quote and explain any expressions in this play referring to the Feudal system.

Tempest.

1. Under what circumstances and by whom was spoken the passage beginning :—

'All things in common Nature should produce,' *et seq.*

2. Sketch the character of Caliban, with illustrative quotations.

3. What are the Unities, and how may they be said to have been observed in this drama?

Macbeth.

1. Who says and what is the allusion?
   (*a*) 'Angels are bright still, though the brightest fell.'
   (*b*) 'Thy crown doth sear mine eyeballs.'

2. Scan : 'All mortal consequences have pronounced me thus.'

3. Contrast the character of Malcolm and Macduff.

4. Compare the soliloquies in this play with those in Hamlet and Othello.

FIRST YEAR—WOMEN.

Reading.
Penmanship.
School Management.
Composition.
Music.
English.
History.
Geography.
} As First Year Men.

Needlework.

1. Draw a diagram of an infant's shirt to scale ($\frac{1}{4}$) front view.

2. What are strengthening tapes, and where used?

3. Give directions for making a button-hole, and sewing on an unpierced linen button.

Domestic Economy.

1. Compare the constituents, and explain the relative values of these drinks :—Coffee, cocoa, tea, ale, and whisky. Point out any risks that you believe to be connected with the use of any of them.

2. Explain fully why mischief should ensue—
   (*a*) From not airing bed-clothes daily.
   (*b*) From not properly airing under-clothing.

3. What is the ordinary or 'normal' temperature of the human body in health ; and how can it best be kept uniform?

4. Whence do we obtain our supply of raw material of silk, cotton, wool, and linen? Compare cotton and linen, as regards their price, their qualities, and their suitableness for use as under-garments.

5. Give clear instructions for making (*a*) a loaf of bread, and (*b*) an Irish stew.

6. Describe fully, with particulars respecting price, the outfit suitable for a young girl of 16 going out to service.

Arithmetic.

1. Find the simple interest on £325 8s. 4d. for 3 months at 4 per cent. per annum, and the real discount of £328 13s. 5d. due three months hence at 4 per cent. per annum.

2. In 1850 the population of a certain city was 129,181, and in 1861 it was 113,387 ; find its decrease per cent.

3. Having purchased 500 eggs at 1d. each, and as many more at 2 a penny, I sold all at 3 for 2d. ; how much did I gain or lose?

4. A £50 railway share, which cost me £55, pays a yearly dividend of £6 ; what is my rate of interest?

5. If I mix 25 lbs. of tea at 3s. per lb. with 20 lbs. of tea at 2s. 9d. per lb., at what price must I sell the mixture per lb.?

6. Divide 85 into 2 parts so that $\frac{2}{3}$ of the one may be $\frac{3}{4}$ of the other.

SECOND YEAR—WOMEN.

Reading.
Penmanship.
School Management.
Teaching.
Composition.
Music.
English.
History.
Geography.
} As Second Year Men.

Needlework.

1. Draw a diagram ($\frac{1}{4}$ scale) for cutting out a saddle yoke.

2. With such a yoke, what changes are necessary in cutting out a night dress?

3. Give directions for making up, and show on calico supplied all the stitches required.

Domestic Economy.

1. Suppose the managers of an elementary school intend to establish a cooking class, what sort of room and what apparatus would you advise them to procure? Sketch out the first six lessons of a suitable course.

2. How would you discover that a child was falling ill with (1) measles, (2) mumps, (3) scarlatina?

3. Give a plan for the ground floor and upper floor of a working man's cottage.

4. Why are lime walls healthier than those covered with paper, and how is lime-washing done?

5. What are the advantages of stewing meat? Say how you would make Irish stew, and give the cost and quantities of the ingredients, supposing that a meal has to be furnished for a father, mother, and three children.

6. Explain the qualities and uses of (1) borax, (2) soda, (3) oxalic acid, (4) chloride of lime.

Arithmetic.

1. No. 1. Men.

2. No. 2. Men.

3. The longer sides of two rectangles are 189 and 244 yds., their shorter sides 45 and 36 yds. Find the area of a square that is intermediate in area to the two rectangles, and whose sides consist of an exact number of yards.

4. No. 3. Men.

5. No. 4. Men.

6. No. 5. Men.

NOTES ON MARCH QUESTIONS.

ARITHMETIC—*Men.*

1. $\frac{1}{4}$.

2. A + B in 1 min. fill $\frac{1}{25} + \frac{1}{10}$.
   in $8\frac{2}{3}$,, ,, $\frac{11}{150} \times \frac{43}{5}$.
   ∴ part to be filled by A is $\frac{375 - 231}{375}$, etc.
   Ans. 18 mins.

3. In the hour Rugby train has gone 25 miles, and is 55 miles from London.
   Trains approach at 66 miles per hour.
   ∴ time to meet is $\frac{55}{66}$ hours.
   Distance from London $34\frac{1}{2}$ miles.

4. Add reciprocals of times, which gives
   A + B + C together will do work in 14 hours.
   Then subtracting what can be done by B + C, we get A does $\frac{7}{183}$ in 1 hour, or does whole in 36 hours 24 mins.
   Similarly B in 26 hours.
   C in 182 hours.

5. A travels $\frac{7}{8}$ miles in 1 hour.
B " $\frac{5}{8}$ " "
∴ B gains per hour $\frac{1}{12}$ miles.
In 8 hours A travels $\frac{56}{8}$ miles.
∴ B will require $\frac{56}{8} \div \frac{1}{12}$ hours, or 42 hours.
∴ A will have travelled before being overtaken (8 + 42) hours, or 70 miles.

6. $9\frac{3}{8}$ miles.

ALGEBRA—*First Year.*

1. Multiply N. and D. of each by 6 before substitution.
Ans. $\frac{1}{2}$.

2. (*a*) $(x-17)(x+3)$; (*b*) $b(x^3-9^3)$ or $(x-9)(x^2+9x+81)$; (*c*) $\{(x+a)^2-(x-a)^2\}\{(x+a)^2-(x-a)^2\}$; or $8ax(x^2+a^2)$.

3. The H.C.F. of numerical coefficients and detached letters is $49fg^2r$, and working by detached coefficients for other part gives $(x-3)$.
∴ H.C.F. is $49fg^2r(x-3)$.

4. (*a*) $\frac{2a^2x}{x^2-a^2}$.

(*b*) Put $x^{\frac{1}{3}}=a$, $y^{\frac{1}{3}}=b$,
then E becomes $\frac{a(a^3+2^3b^3)}{a^2+2ab+2^2b^2}$,
from which the result follows $x^{\frac{1}{3}}(x^{\frac{1}{3}}-2y^{\frac{1}{3}})$.

5. $1-2x-2x^2-4x^3$, etc.

6. (*a*) $x=9$.
(*b*) $x=1$ or $\frac{53}{9}$.
(*c*) Divide (1) by (2).
$$\frac{x}{x-y}=6.$$
or $6xy=5x^2$.
Substituting in (1) $x=\pm 6$.
$y=\pm 5$.

7. Let $a-2d$, $a-d$, a, $a+d$ be numbers;
then $d=\pm 6$,
$a=\pm 3$.
Nos. are ± 3, ± 9, ± 15, ± 21.

8. Putting x, y, z for cost price, selling price and lbs. sold, we have
$$z(y-x)=12x,$$
or $2x=y$,
$z=12$.

Second Year.

1–8. As First Year.

9. Bookwork.

10. "

11. The men who can only steer can be distributed in $\lfloor 5$ ways.
The remaining 20 men can be distributed in sets of four in
$$\frac{\lfloor 20}{(\lfloor 4)^5} \text{ ways.}$$
∴ Crews can be chosen in $\frac{\lfloor 5 \ \lfloor 20}{(\lfloor 4)^5}$ ways.

12. Bookwork.

13. (*a*) Cubing and collecting,
$$8x^3=-27x(x+1)$$
or $8x^2+27x+27=0$
whence $x=\frac{-27\pm 3\sqrt{-15}}{16}$.

(*b*) Multiply (1) by $3xy$, and (2) by $3y$, and subtract.
$$20xy-3=\frac{5y-3x}{x},$$
whence $x=\pm\frac{1}{3}$
$y=3$ or $\frac{1}{3}$.

(*c*) If a and b are the roots of $x^2-2fx+g=0$,
then $a+b=2f$, $ab=g$;
also $(b-c)+(a+c)=2f$ } from the other equation.
$(a+c)(b-c)=r$ }

From the bookwork $a-b=2\sqrt{f^2-g}$.
$$\therefore E=c^2+c(a-b)-ab+(b-c)(a+c)$$
$$=c(a-b)-c(a-b)$$
$$=0.$$

14. Let x, y, z be respective times.
Then $\frac{4}{x}=\frac{1}{y}+\frac{1}{z}$ (1)
$$\frac{3}{y}=\frac{1}{x}+\frac{1}{z} \quad (2)$$
or $\frac{5}{x}-\frac{4}{y}=0$, or if t be any integer,
$x=5t$, $y=4t$.
Substitute in (1) and we get $\frac{4}{5t}-\frac{1}{4t}=\frac{1}{z}$,
or $z=\frac{20t}{11}$.
Then $\frac{\frac{1}{z}}{\frac{1}{x}+\frac{1}{y}}=\frac{\frac{11}{20t}}{\frac{9}{20t}}=\frac{11}{9}$.

ARITHMETIC.

First Year—Women.

1. £365 17s. $11\frac{3}{4}$d.
2. $2\frac{11}{15}$.
3. 1 qr. 15 lbs. 5 ozs.; ·15.
4. 92 miles.
5. $166\frac{2}{3}$.
6. $5\frac{5}{8}$ yrs.

Second Year.

Same as men.

THE NEW CODE.

THE New Code which is just issued will not be remembered as containing any sweeping alterations or any startling innovations. The first impression, therefore, in looking it through is one of disappointment, for there are so many points, trifling perhaps, considered separately, but of great importance to the teacher, which might readily have been altered.

But, on the other hand, it must be conceded that the alterations which have been made are in the main satisfactory.

We proceed to point out the chief changes, and our readers may judge for themselves.

In Art. 15 Suitable Occupations are dismissed from the Obligatory Subjects, while Object Lessons in Standards I, II., and III. are retained for any school year beginning after the 31st August 1895. After the last section 'one of the "Class Subjects" mentioned in Art. 15 (*b*) (1) is added,' which for any school year beginning after the 31st August 1896 must be Object Lessons in Standards I., II., and III. (or in the lower group in schools taking schemes in Schedule 'S').

The articles referring to pupil teachers are modified considerably and in the right direction. Candidates on probation become probationers until they are eligible to be pupil teachers, or until they are sixteen years of age; they are not to be less than thirteen years of age at the commencement of their engagement. Those who become probationers on or after 1st July 1897 will only be permitted to teach half the time that the school is open.

On and after the same date pupil teachers must not be less than fifteen years of age at the beginning of their engagement, and the maximum time allowed for them in school is reduced from 25 to 20 hours per week.

Provision is also made for the admission of pupil teachers for a *one* year's engagement, provided they have passed certain specified examinations. These measures for the relief of the over-worked child-labourers in our schools are decidedly satisfactory.

Under Art. 60 a new section is added:—'Graduates or persons who are qualified by examination to become graduates in Arts or Science of any University in the United Kingdom, may be recognised as certificated teachers provided that they hold a certificate of proficiency in the Theory and Practice of Teaching issued by a University or Collegiate body, and recognised by the Department.' These teachers will be qualified to superintend pupil teachers.

The time which must elapse after passing the Certificate Examination and the receipt of the parchment must not be less than eighteen months, but only one report is necessary.

A new subsection to Art. 82 provides that a school with an average of not more than 30 scholars may receive a grant, if the principal teacher is qualified under Arts. 50 and 51, and specially recommended by the Inspector for skill in teaching.

A new Art.—87—demands, under a fine of £1, the notification to the Inspector of all occasions upon which the school is closed—usual and unusual.

A new subsection of Art. 101*e* states that Drawing may not be taken as a suitable occupation in any school receiving a grant for Drawing from the Science and Art Department.

In accordance with Sir John Gorst's promise in the House, the number of pensions are increased, those of £30 from 36 to 44, of £25 from 197 to 232, of £20 from 283 to 335, representing a total of £1,155.

We now come to the part which will be scanned most eagerly—the various Schedules.

Schedule I. Arithmetic Scheme A and B. Common weights and measures are required in Standards V. and VI., and area is omitted from the 4th Standard and added to the 6th and 7th (for Boys only), together with volume (cubic yard, foot and inch). The extraction of square and cubic roots is not required.

Schedule II. A scheme—B —is added in Elementary Science, and a scheme B in History; Standard III., taking 12 stories to 1066; Standard IV., 20 stories, from 1066 to 1485; Standard V., the Tudor Period; Standard VI., the Stuart Period; and Standard VII., the Hanoverian Period.

As a supplement to Schedule II., a new course (D) in English is given, designed to do without technical terms in the lower standards, which is in close accordance with the ideas of Professor Meiklejohn in his 'English Lessons,' and which, of the four courses given, seems to be the most preferable.

On this same schedule also alternative courses in English, Geography and History, are provided for schools which take other class subjects in the lowest Three Standards; thus in Geography, Standard IV. takes Definitions, Standard V. Physical and Political Geography of the British Isles, Standard VI. Australia, Canada, South African Colonies, India and Ceylon. Standard VII. The Colonies generally and the seasons.

Schedule III. The needlework requirements are unaltered, except that 'Putting on tape loops and strengthening tapes' is added in Standard V. The needlework for Pupil Teachers is entirely recast.

Schedule IV. The French and German specified books are altered for 1897.

Schedule V. Several important alterations have been made in the work of Pupil Teachers. First Year Pupil Teachers will not be required to Read, Recite or Teach, the Recitation of 2nd and 3rd Year Pupil Teachers is not confined to the specified books, and these have been altered for 1897. 'Gray's Elegy in a Country Churchyard' for 1st Year, Cowper's Task, Bk: IV. (lines 1–363) for 2nd Year, and Shakespeare's Julius Caesar for Third Year. 'French is given as an alternative subject to English, and (new) in 1897 pupil teachers will have the option of taking a paper in Physiography according to a Syllabus to be contained in the Directory of the Science and Art Department, or to be bought separately.' The 'Metric System' is added to the Second Year Arithmetic.

Schedule VII. Very few modifications are made, the chief being that the gallery in babies' room should not hold more than 50.

THE REVISED INSTRUCTIONS.

The 'Instructions' annually increase, and will soon form a complete manual on School Management and the Art of Inspecting. There are some points in this year's publication which deserve notice.

The term, 'schools which have reached on the whole a good educational standard,' which has caused some heart-burnings this year, is thus amplified, '*i.e.*, schools in which a standard of work, well above the level of inefficiency, has been steadily maintained for a sufficient time to show that there is no probability of their falling below that level.' This will have the tendency to exempt many more schools than has hitherto been the case. Considerable stress is laid upon the production of a habit of study, and a valuable suggestion is made which we quote *in extenso*. 'While the present school year will be retained for financial purposes, a distinct school year (say from January to January) may be adopted for educational purposes, and divided, as in most schools for higher grades, into three terms. If this arrangement were commonly adopted, children might pass from school to school at any period of the year, and find in each a class in their own state of progress, and thus the difficulty of classification of new scholars, especially in Arithmetic, would be avoided. The year's work might be distributed equally over the first two terms, and the third term devoted to the widening and deepening of that work; a clever child promoted at the end of the first or second term would readily, with a little guidance, overtake the other members of the class.'

It is further impressed upon Inspectors that their visits of inspection are to be in no sense formal examinations, but should be devoted to observation of the ordinary working of a school.

In talking of Object Lessons, the use of stuffed specimens of birds and animals is deprecated, and under 'Other Occupations' the cultivation of inventiveness is insisted upon as one of the chief uses of such occupation.

The classification of scholars over seven years of age, and the placing of many of them in a class preparatory to Standard I. is criticised, and the Inspector directed, if he find an unusually large number in this class, to make a special inquiry into the matter.

School Libraries are emphasised as valuable adjuncts to the work of the school, and many points laid down for consideration.

In the Elementary Subjects the teaching of the Metric System to the Fourth and higher Standards is outlined, and examples given, and Scheme B is also enlarged upon, as is also the necessity for the teaching of Weights and Measures by the aid of concrete examples.

The new scheme in English is further defined and illustrated, and the remarks upon Physical Exercise amplified—the practice of performing exercises whilst standing upon the school benches being stigmatised as 'bad,' although in some cases there is practically no other place of having them done.

An important appendix is added on Needlework, the exercises which an Inspector may give in the various classes being tabulated, together with the materials required in such tests.

In Registration, when a scholar leaves before the completion of the minimum time, his attendance must be *immediately* cancelled, and the number of those who have thus left be entered *before the close of each meeting*.

Last year's requirement that the songs should be by a recognised composer, led Messrs. Curwen to point out that the name of the composer of many national songs was unknown, and this has resulted in 'the songs to be of a good standard character, and guaranteed by their composer's reputation, or by their merited acceptance in the sphere of national or traditional music.'

Circular 369, on Object Teaching, is included as an appendix.

These, briefly, are the changes and novelties of the New Code, which, as we stated above, though not revolutionary in sweeping alterations, is nevertheless not of a reactionary character. As far as important alterations go, it might be aptly styled the 'Pupil Teacher' Code.

HAIL, ALL HAIL!

TRIO FOR S. S. C.

J. GARDNER.

Joyfully.

PIANO.

Key F.
1. Hail, all hail! thou mer-ry month of May . . . . . thou mer-ry month of May. We will has-ten to the woods,
2. Hark! hark! hark! to hail the month of May . . . . . to hail the month of May, How the songs-ters war-ble on,
1. Hail, all hail! thou mer-ry month of May. We will
2. Hark! hark! hark! to hail the month of May, How the
1. Hail, all hail! thou mer-ry month of May. We will
2. Hark! hark! hark! to hail the month of May, How the
Key C. t.
f. Key F.
To the woods . . . . . To the woods . . . . . a - way, A - mong the flow'rs so
war-ble on . . . . . war-ble on . . . . . each spray. And we will be as
hast-en to the woods, To the woods . . . . . To the woods . . . . . a - way, ... A - mong the flow'rs so
songs-ters war-ble on, war-ble on . . . . . war-ble on . . . . . each spray. . . . . And we will be as
hast-en to the woods, To the woods . . . . . To the woods . . . . . a - way, ... A - mong the flow'rs so
songs-ters war-ble on, war-ble on . . . . . war-ble on . . . . . each spray. . . . . And we will be as

rall.
Tempo. f.
sweet and gay, so sweet, so sweet, so sweet and gay. Then a - way,
blithe as they, as blithe, as blithe, as blithe as they. Then a - way,
sweet, so sweet and gay, and gay, and gay, so sweet and gay. Then a - way,
blithe, as blithe as they, as blithe, as blithe, as blithe as they. Then a - way,
sweet, so sweet and gay, and gay, and gay, so sweet and gay. Then a - way,
blithe, as blithe as they, as blithe, as blithe, as blithe as they. Then a - way,
Then a - way, Then a-way, a-way, To hail the mer - ry, mer-ry month of May, To hail the month, the month of May.
Then a - way, Then a-way, a-way, To hail the mer - ry, mer-ry month of May, To hail the month, the month of May.
Then a - way, Then a - way, hail, all hail! To hail the month, the month of May.
Then a - way, Then a - way, hail, all hail! To hail the month, the month of May.
Then a - way, Then a - way, hail, all hail! To hail the month, the month of May.
Then a - way, Then a - way, hail, all hail! To hail the month, the month of May.

'THE PRACTICAL TEACHER'S LIBRARY.'

II.—SAINTSBURY'S NINETEENTH CENTURY LITERATURE.

THOUGH the nineteenth century is nearing its close, it has still a few years to run; and to some persons the publication of a history of its literature may seem something like the premature publication of an obituary notice during the life-time of its subject. To this somewhat shallow objection it may be sufficient reply to recall the common-place, that with relation to the general current of history, literary or other, the beginning and end of a century are merely arbitrary points of division, and that if they happen to form real and suitable points of departure, the coincidence is only accidental. But if this does not suffice, a more conclusive answer is forthcoming. The period covered by Mr. Saintsbury's volume is from 1780 to 1895, and the title he has given it—A History of Nineteenth Century Literature—is a matter of approximation and convenience.

The feeling that it is hardly practicable to continue a history of literature down to so recent a date as last year, and altogether vain to attempt a genuine critical estimate of the value of work so lately produced might be regarded as representing a sounder objection. But so far as it relates to the work before us this admits of a two-fold reply. Though the year 1895 marks the end of the period treated, the work of living writers, with one exception, is excluded from the purview of the historian; and the present seems to be a time of pause and transition when it may be well to take stock of our position.

In this solid octavo volume of nearly five hundred pages, the author makes a serious and substantial contribution to our educational literature, and provides a means of training readers to a reasonable appreciation of the treasures which the writers of the last hundred years have given to the world. The mass of fact and opinion here presented is very remarkable, and, since the criticism systematically offered is, so far as can be judged from its expression, genuine, discriminating, and independent, it must embody the results of an astonishing amount of reading.

In his remarks on Southey, Mr. Saintsbury says, 'Of the nearly 14,000 books which he possessed at his death, it is safe to say that all had been methodically read, and most read many times; while his almost mediæval diligence did not hesitate at working through a set of folios to obtain the information or the corrections necessary for a single article.' Later, it is stated of De Quincey, that 'His reading was enormous.' Somewhere in his voluminous works we remember this last-named writer makes a calculation as to the possibility, or rather impossibility, of reading all the books in the British Museum Library, and is saddened to find how small a proportion of the whole a rapid reader could hope to read in a long lifetime. When we notice with what readiness and ease Professor Saintsbury is able to dilate on the character of the vast number of works which belong to the period of which he writes, and especially when we remember that he has produced a work of similar scope on an earlier period of unsurpassed brilliancy in literary production—a History of Elizabethan Literature (1560 to 1665)—and also one on French Literature, we feel that our author must also be one whose reading has been enormous. From what we know and read of the now retired statesman—Mr. Gladstone—we should gather that he too is of the class of almost omnivorous readers. But it passes the powers of ordinary mortals to qualify themselves for a place in this class. It is not possible, neither is it desirable, for many to read so extensively.

Still, if we would pass for educated persons, we must read. The late Matthew Arnold was unwearying in his insistence on the need of daily reading as a means of securing and maintaining that acquaintance with the best thoughts of the best minds which to him was the essence of his great desideratum—culture. It is true he added to reading the further requirement of thinking and meditating on the matter read.

The true lover of literature would doubtless find keener pleasure and larger profit in reading the great works of the real creators of literature than in reading mere books about books. But while the number of books is so overwhelming, it behoves all whose available time for reading is limited by other needs and duties to be carefully eclectic in their reading. And here appears the great utility of books like this of Professor Saintsbury's. Besides providing a tolerably full account of the progress of literature, with sketches of the lives of the principal men of letters, and critical summaries of their work, the book may afford fairly trustworthy guidance as to the particular works which may suit the tastes of individual readers, and at the same time be worthy of special attention or study.

Let us now proceed briefly to describe the

Plan of the Work.

Mr. Saintsbury treats his subject in twelve chapters, in which he examines the work of successive groups of writers brought together partly by considerations of time, and partly by the form of their literary production.

The first chapter takes up the tale of the last twenty years of the eighteenth century. The next two chapters deal respectively with *The New Poetry* and *The New Fiction*. Then comes a chapter on *The Development of Periodicals*. After a chapter on *The Historians of the Century*, two others are devoted to *The Second Poetical Period*, and *The Novel since 1850*. The next notices two branches of what our author terms 'applied literature,' namely, *Philosophy and Theology*, and then we return to a consideration of periodical literature in a chapter on *Later Journalism and Criticism in Art and Letters*. A brief chapter reviews the literature of *Scholarship and Science*, and a briefer one still *The Drama*. The last chapter gives a general survey and analysis of the period, with some reflections on the present state of literature.

To traverse the whole of this 'mind-map of the century's literature,' as Mr. Saintsbury calls it, would be beyond the scope and purpose of this paper, and would require far more space than can fairly be occupied with it. We must content ourselves rather with some brief description and illustration of the general

Method of Treatment.

Turning to the first chapter, we find our author showing how the year 1780 actually corresponded 'with a real change, a real line of demarcation,' how the time was one of transition, when the seemingly dying trunk of literature began to bud and burgeon again into visible life. Then are cited the names of four poets—Crabbe, Cowper, Blake and Burns—of whom 'even the most poetical period need not be ashamed.' The main features in the career of each of these writers are rapidly glanced at, some details given of their principal works, and a critical opinion carefully and deliberately expressed and supported by such reasoning as seems fitting to the purpose. To Cowper is given the credit of bringing poetry more into harmony with nature, of displaying in the highest degree the 'faculty of "bringing back the eye to the object," and the object to the eye.' 'He never could have been vulgar; there is not in the whole range of English literature quite such a gentleman in his own way as Cowper. But he has escaped almost entirely from the genteel style—from the notion of things as below the dignity of literature. His prose in this respect is at least equal to his verse, though as it was known much later, it has greater tendency than influence. All good critics have agreed that his letters are not surpassed, perhaps not surpassable. He has more freedom than Gray; he has none of the coxcombry of Walpole and Byron; and there is no fifth name that can be put even in competition with him. Ease, correctness, facility of expression, freedom from convention within his range, harmony, truth to nature, truth to art:—these things meet in the hapless recluse of Olney as they had not met for a century—perhaps as they had never met—in English epistles. The one thing he wanted was strength; as his madness was melancholy, not raving, so was his sanity mild, not triumphant.'

For Burns it is claimed that he could give a voice to passion—passion of war, of conviviality, above all, of love; and that he had an extraordinary command of *genre*-painting of all kinds.

'Perhaps he could only do these two things. But what an "only" have we here! It amounts to this, that Burns could "only" seize, could "only" convey the charms of poetical expression to the more primitive thought and feeling of the natural man, and that he could do this supremely. . . . In his own range there are few depths or heights to which he has not soared or plunged.'

These extracts, from the first few pages of the first chapter, may serve to give some idea of the manner and style of the work; but the rest of this chapter, full of interesting detail as it is, has no other such great names as the four already mentioned, and it is only at the end of the century that the appearance of the *Lyrical Ballads* of Wordsworth and Coleridge gave 'the clarion-call of the new poetry,' and so signalled to the few who recognised its meaning the dawn of new day in literature.

The New Poetry.

Wordsworth, Coleridge, Southey, and Scott are the early poets of the 'New Poetry,' and these are treated in similar fashion to the four of the previous chapter but at greater length. We venture to make quotations from Mr. Saintsbury's criticisms on the first two. Of Wordsworth he says: 'His real poetical merits are threefold, and lie first in the inexplicable, the ultimate felicity of phrase which all great poets must have, and which only great poets have; secondly, in his matchless power of delineating natural objects; and lastly, more properly, and with most special rarity of all, in the half-pantheistic mysticism which always lies behind this observation, and which every now and then breaks through it, puts it, as mere observation, aside, and blazes in unmasked fire of rapture. The summits of Wordsworth's poetry, the 'Lines Written at Tintern Abbey' and the 'Ode on Intimations of Immortality,'—poems of such astonishing magnificence, that it is only more astonishing that any one should have read them and failed to see what a poet had come before the world, are the greatest of many of these revelations or inspirations. . . . The Ode remains not merely the greatest, but the one really, dazzlingly, supremely great thing he ever did.'

Of Coleridge and his *Rime of the Ancient Mariner*, we read: 'Here the stutters and flashes of Blake became coherent speech and steady blaze; here poetry, which for a century and a half had been curbing her voice to a genteel whisper, or raising it only to a forensic declamation, which had at best allowed a few wood-notes to escape here and there, as if by mistake, spoke out loud and clear.' And of Christabel, 'A thousand faults are in it. But there is also something which would atone for faults ten thousand times ten thousand; there is what one hears at most three or four times in English, at most ten or twelve times in all literature—the first note with its endless echo-promise, of a new poetry. The wonderful cadence-changes of *Kubla Khan*, its phrases, culminating in the famous distich so well descriptive of Coleridge himself—

> 'For he on honey-dew hath fed,
> And drunk the milk of Paradise,'

the splendid crash of the

> 'Ancestral voices prophesying war,'

are all part of this note and cry. . . . . Then in the *Mariner* comes the gorgeous metre, . . . the more gorgeous imagery and pageantry here, the simple directness there, the tameless range of imagination and fancy, the fierce rush of rhythm:—

> 'The fair breeze blew, the white foam flew,
> The furrow followed free;
> We were the first that ever burst
> Into that silent sea.'

And thereafter the spectre of Life-in-Death, the water-snakes, the rising of the dead men, the snapping of the spell. There had been nothing like this before, and in all the hundred years, for all the great poetry we have seen, we have seen nothing so *new* as it.'

These passages show how enthusiastically appreciative Mr. Saintsbury can be when he writes of the highest reaches of poetry. In treating of Southey and Scott he does not recognise the same occasion for enthusiasm, though his criticisms are sympathetic as well as discriminating. When he comes to the second flight of the new poets, Byron, Shelley, and Keats, we find a decided note of independence; for after describing how 'Byron's bastard second-hand Romanticism eclipsed the pure and original Romanticism of his elders, Coleridge and Wordsworth, of

his juniors, Shelley and Keats;' and after admitting that there was not only an English but a European concert of praise of Byron's poetry; he writes:—

'Byron seems to me a poet distinctly of the second class, and not even of the best of the second, inasmuch as his greatness is chiefly derived from a sort of parody, a sort of imitation, of the qualities of the first. His verse is to the greatest poetry what melodrama is to tragedy, what plaster is to marble, what pinchbeck is to gold. He is not indeed an impostor; for his sense of the beauty of nature and of the unsatisfactoriness of life is real, and his power of conveying this to others is real also. He has great, though uncertain, and never very *fine*, command of poetic sound, and a considerable though less command of poetic vision. But in all this there is a singular touch of illusion, of what his contemporaries had learnt from Scott to call gramarye. . . . . The really great poets do not injure each other in the very least by comparison, different as they are. Milton does not "kill" Wordsworth; Spenser does not injure Shelley; there is no danger in reading Keats immediately after Coleridge. But read Byron in close juxtaposition with any of these, or with not a few others, and the effect, to any good poetic taste, must surely be disastrous; to my own, whether good or bad, it is perfectly fatal. The light is not that which never was on land or sea; it is that habitually which is just in front of the stage: the roses are rouged, the cries of passion even sometimes (not always) ring false. I have read Byron again and again; I have sometimes, by reading Byron only, and putting a strong constraint upon myself, got nearly into the mood to enjoy him. But let eye or ear once catch sight or sound of real poetry, and the enchantment vanishes.'

Mr. Saintsbury's opinion of Shelley as poet, and of Keats, is far more favourable. Writing of the former, he says: 'There are two English poets, and two only, in whom the purely poetical attraction, exclusive of and sufficient without all others, is supreme, and these two are Spenser and Shelley. Shelley's poetry is almost poetry in its elements, uncoloured by race, language, time, circumstance, or creed. He is not even so much a poet as Poetry accidentally impersonated and incarnate.'

Keats, our author reminds us, spoke of his name as 'writ in water;' and he adds: 'Posterity has agreed with him that it is—but in the Water of Life.' . . . 'Keats, in short, is the father, directly or at short stages of descent, of every English poet born within the present century who has not been a mere "sport" or exception. He begat Tennyson, and Tennyson begat all the rest.'

We have quoted rather largely from this chapter on the earlier poets of the century, and there is much more in it that tempts to quotation, but we refrain. And, simply remarking that such poets as Rogers, Campbell, Moore, Leigh Hunt, Landor, Beddoes, Horne, Hood, and Praed are subjected to similar examination and criticism, though naturally on a smaller scale, we pass on to

The New Fiction.

In novel-writing, as in poetry, Mr. Saintsbury points out that in the early part of the century new notes of promise are struck, and that these heralded much of remarkable achievement. Miss Austen, whose charm and genius are heartily recognised, may be said to lead the way; and then comes Scott, practically the creator of the historical novel, and a wonderfully successful writer in many other forms of fiction. His work was produced, much of it, under the pressure of anxiety and haste, but our author's final opinion is that, in spite of all drawbacks, 'it is such a body of literature as, for complete liberation from any debts to models, fertility and abundance of invention, nobility of sentiment, variety and keenness of delight, nowhere else exists as the work of a single author in prose.'

Bulwer's work was characterised by great variety, and was astonishing in bulk; 'but he had two great faults—want of concentration and want of reality.' A follower of Byron, he indulged too much in sentimental grandiloquence, and in consequence is to be regarded as 'the most illustrious of the innumerable victims of Byron.'

The criticism on Dickens and Thackeray is detailed, of great interest, and, as it appears to us, just; but we must pass it by with only a short quotation on the 'singular and delightful style' of the latter. 'This style is not by any means free from blemishes, though it discarded many of these as time went on. But it has an extraordinary vivacity; a manner entirely its own, which yet seldom or never approaches mannerism; a quality of humour for which no word would be so fit as the old-fashioned "archness," if that had not been so hopelessly degraded before even the present century opened; at need, an unsurpassed pathos which never by any chance or exception succumbs to the demon of the gushing or the maudlin; a flexibility and facility of adaptation to almost all (not quite all) subjects which it is hard to parallel.'

Before the close of the chapter, Mr. Saintsbury discusses rather fully the work in fiction of many of the contemporaries of Dickens and Thackeray, but at length he has to exclude the crowd, and he closes this part of his book with this general remark on prose fiction:—'The safest of life (except poetry) of all literary kinds when it is first-rate, it is the most certain of death when it is not; and it pays for the popularity which it often receives to-day by the oblivion of an unending morrow.'

The Development of the Periodical

is next considered as one of the most striking and distinctive features of English literary history of the nineteenth century. As a mere chronicle this chapter is intensely interesting, with its record of such names as Cobbett, Jeffrey, Sydney Smith, Charles Lamb, Hazlitt, Lockhart, 'Christopher North,' De Quincey, Leigh Hunt, Hartley Coleridge, and Maginn. All these became known chiefly through their contributions to the periodical press, and most of their best known work now consists of collections of such contributions. For comments on these productions and on the history of the great reviews, the *Edinburgh* and the *Quarterly*, the literary magazines of *Blackwood* and *Fraser*, we must refer our readers to the book itself. So must we also for the important matter of other sections of the work. Space would altogether fail us to do justice by analysis or quotation to the records of the historians of the century. Hallam and Lingard, Milman, Grote, and Thirlwall,

Macaulay the brilliant, and Carlyle the Titanesque. Suffice it to say that all these, and many others, receive careful and adequate treatment.

The chapter on the Second Poetical Period, particularly the pages devoted to Tennyson and Browning and Matthew Arnold, abound in temptations to quote. We must content ourselves with two or three sentences. 'The influences of Pope and Dryden were weak in force and merely external in effect, the influence of Byron was short lived, that of Wordsworth was partial and limited in comparison with the influence of Tennyson.' 'We have had greater poets than Tennyson. . . . . But we have had none so uniformly, and over so large a mass of work, exquisite.' . . . . 'Take any one of a myriad lines of Tennyson, and the mere arrangement of vowels and consonants will be a delight to the ear; let any one of a thousand of his descriptions body itself before the eye, and the picture will be like the things seen in a dream, but firmer and clearer.'

Of Browning's lyrics Mr. Saintsbury says:—'The beauty, the charm, the variety, the vigour of these short poems are as wonderful as the number of them. He never lost the secret of them to his latest years. . . . . There are half a dozen pieces in *Asolando*, latest of all, which exhibit to the full the almost bewildering beauty of combined sound, thought, and sight, the clash of castanets and the thrill of flutes, the glow of flower and sunset, the subtle appeal for sympathy in feeling or assent in judgment.'

We must now pass over whole chapters, for, as our author says at the end of one of them, 'All doors must be open or shut, and this one must now be shut.' We must leave the further consideration of individual and separate accounts, and proceed to the general conclusion.

Balancing the Books.

Literature does not admit of mathematical treatment, though we remember reading a text-book of the history of English literature in which diagrams of geometrical design were introduced to represent the relations of writers and classes of writers to each other. Neither can we adopt any method of account-keeping by which we can strike an exact balance of literary losses and gains. All this Mr. Saintsbury recognises. Still we can take reasonable note of the achievements of our century; we are bound to observe the inevitable silencing of the poet's sweetest strains; we can look round us and see if any signs at present above the horizon will help us to determine 'how we stand.' All this is what Mr. Saintsbury endeavours to do in the last chapter of his book, which he says might almost as fitly have been a preface as a conclusion. Among the great periods of literature he considers that the nineteenth century in England, 'has taken its place finally and certainly, with a right never likely to be seriously challenged, and in a rank never likely to be surpassed. The period which lisped its numbers in Burns and Blake and Cowper, which broke out into full song with Wordsworth, Coleridge, Scott, Byron, Shelley, and Keats, which, not to mention scores of minor singers, took up the tale with Tennyson and Browning, and passed it on to Arnold, Rossetti, Mr. Morris, and Mr. Swinburne, need fear no comparisons in the matter of poetry. In prose fiction it stands alone. It is almost a century of origins as regards the most important kinds; it is quite a century of capital and classical performance in them. In 'making'—prose or verse—no time leaves record of performance more distinguished or more various.'

Of the present and possible future of English literature our author speaks with a less certain note. He recognises the rashness of prophecy; but he recognises also that there are signs of change, whether of transition merely or of decadence it is more difficult to say. He rather inclines to the opinion that we are entering upon the experience of a dead time, or at least a dull season; and he supports his view with some such reasons as these—the flourishing period of poetry has lasted longer than any such period previously: the greatest masters of poetry are dead—Tennyson and Browning, who wrote as contemporaries for over sixty years, and nearly all the older members of a younger generation; the great historians down to Freeman and Froude, and nearly all the other great masters of prose have also passed away; and even in the good work of our younger writers we find notes or symptoms of transition or decay, among them imitation, exaggeration, and the uncertain and eccentric quest for novelty. 'Another *Lyrical Ballads* may be coming for this decade, as it came a hundred years ago: all we can say is that it apparently has not come yet.' Only, one need not despair or torment oneself about the approaching decline of literature when one 'sees how constantly, how incessantly, the apparently dying flower has shed seed and shot suckers for a new growth.'

Summing up.

As we close the volume we feel that we have traversed a very extensive tract in the company of a fully informed and truly intelligent guide—in the matter of fluency, a *cicerone* indeed. His tone smacks somewhat of the Professor, and is at least confident, but not perhaps quite deserving the epithet of dogmatic. His criticism is sincere and for the most part sound, by no means superficial, but not in any marked degree subtle. His judgments are discriminating, and as a rule just, though he is not altogether that paragon of impartiality—a person without prejudice or bias. Here and there are indications of what seems to be an aristocratic and exclusive tendency in regard to letters, or perhaps it would be better to say signs of anti-democratic feeling. This has led him, we think, to deal somewhat slightingly with some writers on the popular side, and to depreciate the influence of some liberal thinkers; for example, he seems to have done less than justice to Frederick Denison Maurice, and rather to grudge the credit he cannot avoid giving to John Stuart Mill.

In the concluding chapter we had been watching for some reference to the spread of education among the people as a factor in moulding the course of literary development, and when at last we came upon it on page 444, we could not help recalling the author's boast in another of his books, that he is something of a cavalier, and we thought that he treated the cause of popular education somewhat 'cavalierly.' 'There is no doubt,' he says, 'that the popularity of the novel has been very directly connected with a cause which has had all manner of

effects fathered upon it—often with no just causation or filiation whatever—to wit, the spread of education. In the proper sense, of course, the spread of education must always be strictly limited. The number of educable persons probably bears a pretty constant ratio to the population, and when the education reaches the level of the individual's containing power, it simply runs over and is lost. But it is possible to teach nearly everybody reading and writing; and it is a curious but exact observation that a very large proportion of those who have been taught reading, require something to read.' Hence, of course, the increasing demand for novels, and the consequent unfailing supply. This seems to us a very imperfect account of the relation of popular education to literature; but this is the sum of what Professor Saintsbury vouchsafes to give.

In the matter of style Mr. Saintsbury is fluent, varied, and readable; but he can hardly be called a great master. He has, indeed, some rather irritating tricks. The chief of these is the excessive use of the parenthesis, to which weakness our extracts, though chosen for altogether different purpose, bear sufficient witness. This habit of parenthesising effectually prevents his style from being what is known as a flowing style, and the same characteristic causes its failure at times to be quite clear and compact. Sometimes we come across a very odd collocation of words. Thus, 'For the moment, however, Miss Austen's influence had not so much little influence as none at all.'

Still, after all deductions have been made for faults of style, and for the influence of personal prejudices, we come back to the opinion we indicated at the outset of this paper, that we have in this volume a substantial and valuable contribution to the history of English literature, and one which thoroughly deserves the attention of all those who find in our literature a subject of perennial interest.

OUR PRIZE COMPETITION COLUMN.

FRENCH.

Prize Editor.—J. J. BEUZEMAKER, B.A.,
Examiner in French to the College of Preceptors.

PRIZE AWARDS—MARCH.

The Prize is awarded to *Pater*, the pseudonym of E. J. POPE, Commercial School, Brimscombe, Stroud.

Class I.—Pater, Crosbeian, Espérance (Herefordshire), Jean, Scotia (Ayrshire), Jubilarian, Joseph.

Class II.—Eric, Medina Stretton, Merlin, A Lover of France, Français, Aurora Leigh, L.E., Dissentient, Marguerita, Flotsam, Gabrielle, Camarade, Floreat Etona, Ivan, Ordag, Poppy, Idris Mawr, Bristoliensis, An English Girl, Kent, Nortoniensis, Lily, Nemo, *γνῶθι*, Onyx, One and All, Elpis, Marjorie, Robur, Ignatius, Clio, Demos, Firenze, Une personne aventureuse.

Class III.—La petite, Orchid, Erimus, Antoine, Maritana, Rosa, Arrandoon, Nemo, Robin, Lily Waters, Karen, Scotia, Hyacinthus, Tête en l'air, Seventeen, Beth, Zoë, Vain hope, Birmingham, Hayter, Midshipmite, Achilles, Dabriada, Fide et Virtute, A.L.L.A., Téméraire, St. Clair, Fleur de Lys, Popsy, Percy, Ala, Winefride, Hugo, Charron, Mizpah, Murray, Oceana, Cosmopolite, Harry Brown, Polly Perkins, Dot, D.O.D., St. John's, Max O'Rell, Jacques, Snowdrop, Yeo, Tanganyika.

Class IV.—Nil Desperandum, Dick, Pierre Larousse, Zenobia, Calcaria, Lily of the Valley, Stockburn, Espérance, Petite, De Villars, Rea, Ironopolis, Excelsior, Rose.

Alexandre Dumas était un pessimiste. La nature humaine lui semblait laide, basse et méchante. S'il avait espéré l'améliorer, et si cette espérance l'avait soutenu longtemps, il est certain qu'à force de constater le mal, d'analyser l'égoïsme individuel ou social, de proposer des remèdes que le malade n'acceptait pas, et de flétrir des vices qui conservaient, après le châtiment, la même force et la même arrogance, il en était venu, non pas à regretter ce qu'il avait fait, mais à constater que le mystère du bien et du mal reste impénétrable; que le bien gagne peu et lentement, que le mal est tenace et renaît de lui-même; que le sens de la vie reste obscur; que toutes les explications et toutes les consolations de la misère humaine, toutes les philosophies, et toutes les religions ne sont que des moyens insuffisants, imaginés par l'homme pour soulager son effroyable misère,—misère plus ou moins atténuée et diminuée, mais éternelle.

A mesure qu'il avançait dans la vie, cette conviction devenait plus impérieuse et plus triste. Il voyait plus nettement non pas l'inutilité, mais l'insuffisance de l'effort humain vers la justice, la vérité et la lumière. Et cette conviction désenchantée coïncidait avec le moment où il entrait de son vivant dans la gloire.

GUSTAVE LARROUMET.

The extract contained scarcely any hard words or idioms. It was merely a specimen of the usual difficulties of turning a piece of good French into English: the apparent identity of words in French and English, *e.g.*, *le sens*, the meaning; the greater clearness of French in the case of short intercalated phrases, *e.g.*, *apres le châtiment*, and the application of metaphor differing in each language, as illustrated in the choice of adjectives, *e.g.*, *conviction désenchantée: La nature humaine lui semblait laide.*

Laide. Many had avoided *ugly*. *Unseemly*, *deformed* are wrong. *Unlovely* is better than *repugnant*. The word *unbeautiful* does not exist.

Constater le mal. To find, to estimate, to ascertain, to proclaim, to expose, to declare the evil, are one and all wrong. *Constater* is here used in the sense of *to state, to demonstrate the existence of.*

Qui conservaient, après le châtiment, etc. The literal rendering of this clause has sent several into a lower class.

Le sens, the meaning, not the sense, the reason. Phrases like *raison d'être* are not admissible in a prize translation.

Cette conviction désenchantée. Neither *disenchanted*, nor yet *disenchanting* will do. The meaning is, stripped of all illusion, plain, unlovely, depressing.

De son vivant, in his life-time, was mistranslated by many.

Several translations were very free, a defect as soon as the meaning suffers.

We subjoin a fair copy.

Alexander Dumas was a pessimist. Human nature to him seemed unlovely, base, and wicked. If ever he had hoped to better it, and if this hope had been abiding, there is no doubt that by demonstrating the existence of evil, by analysing egotism, individual as well as social, by suggesting remedies which the patient would not accept, and by stigmatising vices, which, after they had been punished, asserted themselves as arrogantly as before, he would in the end not have regretted his efforts, but have acknowledged that the mystery of good and evil remains inscrutable; that virtue gains ground very slowly, and that vice is tenacious and self-begetting; that the meaning of life remains an enigma; that all attempts at explaining and assuaging human misery, all philosophies and all religions, are but feeble means of man's own devising to alleviate his frightful wretchedness—a wretchedness varying in degree, but everlasting.

As he advanced in life, this conviction became more dominant and gloomy. He saw more clearly not so much the uselessness, as the futility of human effort to attain justice, truth, and knowledge. And this unlovely conviction was borne in upon him when his fame had reached its zenith.

APRIL PRIZE COMPETITIONS.

A Prize of One Guinea will be given for the best translation into English of the following extract:—

'Il est incontestable que beaucoup de contrastes sont risibles. Dans une parodie, l'effet comique est produit par le contraste entre la gravité de l'œuvre originale et l'irrévérence du travestissement. Dans une naïveté d'enfant, ce qui nous fait rire, c'est le contraste entre la portée du mot et la candeur de celui qui le dit. Certaines transpositions font rire pour une raison analogue: une tragédie traduite en style trivial, une aventure cornélienne caricaturée en scène bourgeoise, les sentiments sublimes exprimés en argot parisien, l'héroïsme sur le ton pot-au-feu; certaines conférences de M. Sarcey sont, à ce

point de vue, d'un comique irrésistible. Le clown qui s'élance, grisé d'enthousiasme, pour imiter l'écuyère, et qui s'aplatit lourdement sur le sol, cause le rire en provoquant une impression forte et grossière de contraste.

Mais il y a beaucoup de contrastes qui n'ont rien de risible. Le *couac* d'un chanteur, dans la plupart des cas, est tout simplement pénible : c'est pourtant un effet de contraste. Au lieu du clown, si c'est l'écuyère elle-même qui tombe, le contraste entre sa chute et sa voltige de tout à l'heure est très net : pourtant aucune envie de rire. Un mot qui, en lui-même, serait plaisant, précisément s'il est prononcé dans des circonstances solennelles avec lesquelles il fait contraste, cesse de l'être: rien d'insupportable comme un compagnon facétieux quand on est recueilli dans l'admiration ou dans la tristesse. Tout ce qui détonne fait contraste, et pourtant ne fait pas rire.

CAMILLE MÉLINAND.

A Prize of Half-a-Guinea will be given for the best set of answers to the following :—

1. Give a sentence containing *mode* (m.) and *mode* (f.).

2. Translate into English :—Rêver, c'est s'équiper en chasse et partir pour penser, quitte à revenir bredouille.

3. Translate into French :—The excesses of our youth are drafts upon our old age, payable with interest about twenty years after date.

4. Correct :—Ramenez vos amis jusqu'à la derhière porte. C'est trop rude de les donner congé au sommet de l'escalier.

5. Who wrote :—*J'ai ri, me voilà désarmé ;* and where ?

RULES.

1. All translations should be posted not later than April 10, and addressed :—*Prize Editor*, Office of THE PRACTICAL TEACHER, 33, Paternoster Row, London, E.C.

2. Competitors should cut out, and send the Coupon which appears on the Back Wrapper page of the current number.

3. Competitors should adopt a pseudonym, and send name and address written on a separate piece of paper.

4. Teachers employed exclusively in teaching modern languages are not eligible as prize-winners.

MODEL ANSWERS TO QUESTIONS SET AT THE QUEEN'S SCHOLARSHIP EXAMINATION.

CHRISTMAS 1895.

(*Continued from page* 479.)

LATIN.—MEN AND WOMEN.

Friday, December 20th, 1.30 to 3.30.

1. Translate into English :

Hominum est infinita multitudo creberrimaque aedificia, fere Gallicis consimilia ; pecorum magnus numerus. Utuntur aut *aere*, aut nummo aereo, aut taleis ferreis, ad certum pondus examinatis, pro nummo. Nascitur ibi plumbum album in mediterraneis regionibus, in maritimis ferrum, sed ejus exigua est copia : aere utuntur importato. Materia cujusque generis ut in Gallia est, praeter fagum atque *abietem*. Leporem et gallinam et anserem gestare fas non putant ; haec tamen alunt animi voluptatisque causa. Loca sunt temperatiora quam in Gallia, *remissioribus* frigoribus.

Parse the words in italics.

There is an immense population and very numerous buildings, mostly like buildings in Gaul, and a great number of cattle. They use for money either copper, or copper coin, or pieces of iron weighed to a certain weight. In the midland parts tin is found, and iron in the coast regions, but the supply of the latter metal is scanty : they use imported copper. There is timber of every kind, as in Gaul, except beech and fir. They do not think it lawful to eat the hare, the domestic fowl, and the goose, yet they breed these for the sake of pleasure and entertainment. The climate is milder than in Gaul, the cold being less severe.

2. Translate into English :

Nulla est enim natio, quam pertimescamus ; nullus Rex qui, bellum populo Romano facere possit. Omnia sunt externa unius virtute terra marique pacata. Domesticum bellum manet : intus insidiae sunt : intus inclusum periculum est : intus est hostis : cum luxuria nobis, cum amentia, cum scelere certandum est. Huic ego me bello, Qutrites, profiteor ducem : suscipio inimicitias hominum perditorum.

For there is no nation which we fear ; no king who is able to make war on the Roman people. By the courage of one man, peace has been secured beyond our boundaries both on land and on sea. There remains a war at home : within are treasons ; danger is within, confined to our own borders ; an enemy is within our gates ; a war has to be waged with luxury, with folly, and with crime. I offer myself, O Romans, as your leader in this war ; I offer to incur the enmity of abandoned men.

3. Translate into English :

At hostes, posteaquam ex nocturno fremitu vigiliisque de profectione eorum *senserunt*, *collocatis* insidiis bipertito in silvis opportuno atque occulto loco, a milibus passuum circiter duobus, Romanorum adventum exspectabant : et quum se major pars agminis in magnam convallem demisisset, ex utraque parte ejus vallis subito se ostenderunt, *novissimosque* premere et primos prohibere ascensu atque iniquissimo nostris loco praelium committere coeperunt.

Parse the words in italics.

But the enemy, after they had learned about the departure of these men by the noise at night and by the information given them by the soldiers on watch, having placed ambushes in two quarters in the woods in a secret place, and one suited for their purpose, about two miles distant, waited for the arrival of the Romans. When the greater part of the Roman line had descended into a long valley, they showed themselves suddenly on each side of the valley, and began to press closely on the rear, and to hinder the van from going up, and to force a battle in a place most disadvantageous for our men.

Parsing.

(1)	*Ære.*	Abl. sing. of *es, æris.* Governed in the ablative by *utuntur.*
	Abietem.	Accus. sing. of *abies, etis.* Governed in the accusative by the preposition *præter.*
	Remissioribus.	Adj., comparative degree, abl., plur., neut., agreeing in gender, number, and case with *frigoribus*, with which it forms an ablative absolute phrase.
(3)	*Senserunt.*	Perf. indic., 3rd plur., of *sentio, sensi, sensum, ire*, agreeing in number and person with *hostes.*
	Collocatis.	Perf. participle of *collocare, avi, atum, are ;* abl., plur., fem., agreeing in number, gender, and case with *insidiis*, and forming with it an ablative absolute phrase.
	Novissimos.	Adj., superlative degree, acc., plur., masc., agreeing with *milites* understood, and governed in the accusative by *premere.*
	-que.	Enclitic = 'and,' joining the phrase *novissimos premere* to what precedes it.

4. State in a few lines what Cæsar tells us of the mode of life of the Britanni.

Cæsar tells us that two races inhabited Britain. The inland parts were inhabited by a native race, and the coast regions by tribes who had crossed over from the Continent for the sake of booty. The people of Kent, he said, were the most civilised, and differed but little from the Gauls in their customs. The inland people did not generally sow corn, but lived on milk and flesh, and clothed themselves in skins. They all stained themselves with woad, which gave a dark colour to the skin, and made them appear more dreadful in battle. They wore long hair, and shaved every part of the body except the head and the upper lip. They were a warlike race, and fought in war chariots, but not in close order.

5. Translate into Latin :—

(*a*) On the following day the enemy took their position on some hills far from the camp.

(*b*) So the whole island is 2,000 miles in circuit.

(*c*) Cæsar ordered his soldiers quickly to surround the city with a wide rampart.

(*d*) The Romans, wearied by the toil of the long march, do not withstand (*sustineo*) the attack of the Germans. The Germans kill very many in battle, others in flight ; the rest they take captive.

(*a*) Postero die procul a castris hostes in collibus constiterunt.

(*b*) Ita omnis insula est in circuitii vicies centum milium passuum.

(*c*) Cæsar jussit milites urbem lato aggere celeriter cingere.

(*d*) Romani, labore longi itineris fessi, impetum Germanorum non sustinent. Germani plurimos in pugna, alios fugientes occidunt; ceteros capiunt.

6. State the meanings of 'ut' followed by the subjunctive mood, giving three or four illustrative sentences.

'Ut,' followed by the subjunctive mood, has the following meanings:—

(1) It indicates the purpose of an action, as: *Venit ut spectet ludos*, 'He came to see the games.'

(2) It indicates a consequence, as: *Nemo est tam stultus ut hoc faciat*, 'No one is so stupid as to do this.'

(3) It follows some verbs, like *volo*, *impero*, introducing a sentence which forms the object of the wish, command, etc., as: *Pater vult ut hoc faciam*, 'My father wishes me to do this.' *Cæsar imperat ut milites impetum in hostes faciant*, 'Cæsar orders the soldiers to make an attack on the enemy.'

(4) After verbs of fearing, to signify 'that—not,' as: *Vereor ut me audiat*, 'I fear that he does not hear me.'

(5) With concessive force = although, as: *Ut desint vires, tamen est laudanda voluntas*, 'Although the power (to do some thing) is absent, yet the will (to do it) deserves praise.'

7. State briefly two or three cases in which it has struck you that a knowledge of Latin renders the study of English grammar easier and more intelligent.

A knowledge of Latin renders the study of English grammar easier and more intelligent by increasing our knowledge of the derivation of English words, and thus enabling us to understand them better. Again, since there are more inflexions in Latin than in English, a sentence has to be subjected to a close analysis in order to enable us to understand the function of every word used, so as to be able to give each word its right termination. It thus enables us to analyse English sentences with greater ease and correctness. As there are very few case and other terminations in English, we may very often use a word correctly in English without understanding its exact grammatical use. In Latin we must understand exactly the function of a word, or we may fail to translate it by a fitting Latin word, or give it the right termination. Thus beginners in English are apt to take the word 'ill' in the following sentence as an adverb: 'Your brother looked *ill* this morning.' By comparing the English with the Latin rendering, we see that 'ill' is an adjective referring to 'brother.' Again, 'me' in 'he gave me a book,' might be from its form a direct object in English. By comparing our English with the Latin rendering, we see that 'me' is in the dative case. Lastly, a study of Latin shows us that a great deal of the science of grammar is common to all languages. A study of the grammar of another language strengthens our knowledge of the grammar of our own language, and leads us to take much wider and more comprehensive views of grammar than if our grammatical studies had been limited to our own language.

(*To be continued.*)

PUBLICATIONS RECEIVED DURING MARCH.

FELIX ALCAN (Paris).

Les Caractères et l'Éducation Morale—Étude de Psychologie Appliquée. (Frédéric Queyrat.)

ASHER & CO.

German Dictionary for Home and School. Two. vols. (Flügel-Schmidt-Tanger.)

BLACKIE & CO.

Autobiographies of Boyhood. (School and Home Library.)
A School History of English Literature. (Lee.)
Sarcey's 'Le Siège de Paris.' (Kirkman.)
Selections for Paraphrasing. (Murison.)
The Warwick History Handbooks.
Blackie's Arithmetic. Course 'B.' Standard VII.

BLACKWOOD & SONS.

Passages for Paraphrasing.

CASSELL & CO., LIMITED.

The Life and Strange Surprising Adventures of Robinson Crusoe of York, Mariner, as Related by Himself. By Daniel Defoe. (Original Illustrations by Walter Paget.)

W. & R. CHAMBERS, LIMITED.

Elementary Science Readers. Book I.
Battle of the Lake Regillus. Macaulay. (Trotter.)

W. B. CLIVE.

University Tutorial Series—Cicero: Pro Cluentio. (Mallard.) **Vergil: Eclogues.** (Plaistowe and Masom.)
History of England, 1714-1770. (Evans and Fearenside.)
Manual of Logic. (Welton.)

JOHN HEYWOOD.

Bilingual Copy Books. 1 to 6.

W. & A. K. JOHNSTON.

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H. K. LEWIS.

A Translation of the Annals of Tacitus. Book I. (Weymouth.)

LONGMANS, GREEN, & CO.

Longman's Geographical Series. Book I.

McDOUGALL'S EDUCATIONAL CO. LIMITED.

Exercises in Correcting Grammatical Errors. (Mackie.)
Geographical Reader, Standard III.

MACMILLAN & CO.

A First Sketch of English History. Part II.: 1307-1689. (Mathew.)
Indexing and Précis Writing for Civil Service Candidates. (Evan Jacob.)
Macmillan's Time Tables.

T. NELSON & SONS.

Architects of Fate, or Steps to Success and Power. (Marden.)

G. PHILIP & SON.

Form Building—A System of Kindergarten Drawing.

RELFE, BROS.

Gospel of St. Matthew. With Notes, &c. (Carter.)
Pocket Spellings—1,000 Difficult Words from Exam. Papers.

SAMPSON LOW & CO.

Wall Charts for Class Teaching:—Jackson's System of Upright Hygienic Penmanship.

SMITH, ELDER, & CO.

The Brownings for the Young. (Kenyon.)
The Cornhill Magazine. March.

SONNENSCHEIN & CO.

Elocution for Children. (Foster.)

THE OXFORD UNIVERSITY PRESS.

The 'Thumb' Prayer Book, with Hymns Ancient and Modern. Printed on India paper.

T. FISHER UNWIN.

The Illustration of Books. (Pennell.)
Good Reading about many Books, mostly by their Authors.

WHITTAKER & CO.

Some Elementary Difficulties of French Grammar. (Roach.)

The Golden Penny. London: *The Graphic* Office.

The publishers of *The Graphic* have sent us a volume of this new paper, which is described as 'An Illustrated Home Weekly of Stories, Adventures, Yarns, Sports, Travels, Invention, Dress, Cookery, Health, Garden, and Useful Hints,' etc., etc. A glance at the pages is sufficient to show that this description is not in the least exaggerated. The stories are good, and by well-known writers. The illustrations are numerous, and, as might be expected, thoroughly well up to the mark. A special feature is the Prize Competitions, many of which are most amusing. There is also a School Mapping Competition announced in one of the January numbers. The proprietors state that they will be pleased to send a supply of back numbers to head masters or teachers requiring them for school use as Unseen Readers. The paper is an excellent production and deserves to become popular.

NOTE.

Owing to the great pressure on our space this month we are obliged to hold over till next issue Dr. Hewitt's Organic Chemistry Notes.

Our Science Section.

Subscribers requiring Explanations of Difficulties in any Branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this No.

PRACTICAL CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),

First Class Honoursman in Practical Chemistry (Science and Art Department), Lecturer in Chemistry (Practical and Theoretical) to the Middlesex County Council, Author of Conversational Lessons in Chemistry.

In commencing anew this series of notes, a few words by way of declaration of policy cannot be amiss. The aim of the 'PRACTICAL TEACHER' is to give help where help is most needed. It has been the experience of the writer that help is needed all along the line in the teaching of Chemistry, and, in accordance with this belief the 'Notes' will have a threefold division corresponding to the Elementary, Advanced, and Honours courses of the Science and Art Department's Syllabus, under which divisions, both theoretical and practical questions will be discussed. The struggling teacher, not quite sure as to the best methods to be followed, the private student, who has not the advantages to be derived from class-attendance, will be listened to with closest interest when seeking advice and assistance from these notes of the 'PRACTICAL TEACHER.'

In this month's issue we give the report of the examiners on Inorganic Chemistry in cases where there is serious complaint as to the quality of the answers.

REPORT ON THE EXAMINATIONS IN CHEMISTRY.

INORGANIC CHEMISTRY.

First Stage or Elementary Examination.

Even in some of the best schools weakness was apparent, which is traceable to the *relatively small attention given to inculcating the great principles* of the science along with the necessary facts.

It was abundantly evident from the answers that *too much time is usually given to storing the memory* with mere statements about various operations or changes, and far *too little attention is devoted to training the powers of observation and developing the reasoning faculty.* In effect, this practice aims at making a retentive memory for very partially understood 'explanations' do duty for real knowledge. Chemistry so taught is of very little educational value, possesses small interest for the student, and often ends in his discomfiture at examinations, if he is confronted by questions which vary in any material degree from the conventional form which he has been led to expect.

The obvious remedy for the very serious source of weakness referred to above is to supplement the usual qualitative demonstration of the preparation and properties of the common elements and compounds by a short series of simple and easily performed experiments in proof of the *principle of conservation of matter in chemical change*, of the *law of definite proportions*, and, further, *in illustration of the meaning of the term 'equivalent.'* A student who has been helped to observe, note, and reason upon the results of these elementary demonstrations of the quantitative relations of matter forms more easily than others the necessary conceptions of 'atoms' and 'molecules,' and appreciates the nature of the control of atomic and molecular weights afforded by a knowledge of the relative densities of gases, the specific heats of solids and other general considerations which he is expected to know as he proceeds to the Advanced and Honours stages.

Minor criticisms are appended to the questions as under.

First Stage or Elementary Examination.

1. State the general characters of the metals as a class, and show in what respects they differ from non-metals?

This question was set in order to ascertain whether teachers had acted on the suggestion in last year's report that the *chemical* distinctions between metals and non-metals should be more thoroughly impressed on the minds of students. We regret to say that the answers were, in the great majority of cases, very unsatisfactory.

2. How would you prove the presence of oxygen in nitric and nitrous oxides? State the density of these two gases as compared with hydrogen and with air respectively.

Whenever this question was attempted the answers were generally incomplete, *often consisting merely of the statements that the gases supported the combustion of specified substances and therefore contain oxygen.*

3. Describe the characters and properties of six of the more important carbonates, and write their formulæ.

In general a list of formulæ and names were given, and the characters and properties summed up in the statement 'insoluble white powder.' *In very few cases was the existence of water of crystallization noted.*

4. What is the composition of atmospheric air by volume? Air extracted from water is different in composition from ordinary air; *to what extent, and why is it different?*

Many of the answers to this question revealed a surprising amount of ignorance about the composition of atmospheric air; in some cases it was said to be a mixture of hydrogen and oxygen, in others *argon* was given the chief place, while *very few answered the latter part of the question correctly.*

5. State in words the meaning of each of the following formulæ:—

HCl, NH_3, H_2SO_4, $AgNO_3$, KOH, $ZnSO_4 7H_2O$.

A considerable percentage of the answers gave only the names of the compounds: many other replies showed defective knowledge of the meanings of the terms 'atom,' 'molecule,' and 'volume.' *Some supposed that the last formula represented a solution of zinc sulphate.*

6. Sketch the apparatus you would use in preparing hydrochloric acid gas; explain the chemical action by which you would produce the gas, and describe the properties of the latter. If the chlorine be removed from 10 cubic centimetres of hydrochloric acid gas, what volume of hydrogen will remain?

The first part of the question was usually well answered, but the composition of hydrogen chloride was seldom correctly apprehended, and *elaborate calculations (nearly always wrong) were made in order to find the volume of remaining hydrogen.*

9. Give illustrations of simple combination between two elements, simple decomposition of a chemical compound, the union of two compounds, and formation of compounds by double decomposition?

The answer to this question indicated some confusion of thought and defective teaching. The common term '*double decomposition*' *was very generally misunderstood.*

10. What is the weight of a cubic decimetre of water and the volume of one gramme of water?

Give the English measures equivalent to a metre and to a millimetre.

The English equivalent of the metre was usually given correctly, but little else. It would appear that *the metric system is not yet generally taught in the schools*, but it ought to be understood that candidates presenting themselves at these examinations are expected to be thoroughly familiar with it.

Second Stage or Advanced Examination.

41. Describe the effect of mixing a *solution* of bleaching powder with manganous sulphate, cobalt nitrate, sulphuric acid, sodium carbonate, and hydrogen peroxide respectively?

Seldom attempted, and the answers given were very poor.

42. Classify the common metals, mercury, copper, zinc, antimony, tin, gold, silver, platinum, lead, and iron, according to the action of nitric acid upon them.

Notwithstanding the very specific character of the question, the knowledge of fact possessed by most candidates was insufficient to enable a satisfactory classification to be made. The result indicates that the students were *not exercised in the analytical discrimination of metals or alloys.*

44. Describe any two methods by which you would test the validity of the expression NH_3 for ammonia gas.

Few candidates realised the importance of the determination of density of the gas, or seemed to have any real grasp of the principles involved.

45. Give examples of ferrous and ferric salts; point our their distinctive characters, as well as tests for them; describe and explain the methods by which they can be changed one into the other.

Moderately well answered so far as characters and tests of the two classes of iron salts, but *the latter part of the question was seldom completely dealt with.*

46. If the equivalent of magnesium be 12·1, explain fully how you would proceed in order to ascertain whether or not the equivalent and atomic weights are identical.

This question, like 44, involves theoretical considerations of much importance; but, as in the former case, *the candidates generally failed to supply answers which indicated any real knowledge of elementary principles, or of the application of the law of Dulong and Petit.*

49. Arrange in parallel columns the formulæ of the best known *phosphates* and *arsenates* in such manner as to show that they are closely analagous in composition, and staté in what properties they resemble each other.

Generally very poor. Few students were able even to write the formulæ of corresponding phosphates and arsenates. *Water of crystallization was generally ignored.* The importance of water of crystallization as a constituent of salts and especially where analogies or resemblances have to be brought out is a matter which deserves the attention of teachers.

50. Describe the chief physical and chemical properties of aluminium. From what sources and by what processes is the commercial metal best obtained? Describe any useful alloys of this metal.

Answers somewhat vague; definite knowledge of aluminium, its preparation and properties, very small.

Honours Examination.

A small proportion of the papers were very good, but the great majority afforded little evidence of the accurate and somewhat extensive knowledge to be expected from candidates at an Honours examination.

It was evident that many of the candidates had not received any special training in general chemistry beyond the work for the elementary stage.

PRACTICAL INORGANIC CHEMISTRY.

Elementary Stage.

1. How may barium sulphate be converted into barium sulphide before the blowpipe, and how can you show that this change has been effected? Express the chemical changes by equations.

Few knew anything about the reduction of barium sulphate or of the method by which the fact of reduction can be ascertained.

2. Express by equations the action of solutions of (*a*) caustic potash, (*b*) ammonia, (*c*) potassium iodide, (*d*) *hydrogen sulphide (in excess) on solution of mercuric chloride.*

Generally well done except last case, where nearly all failed.

3. Describe experiments relating to the formation, properties, or decomposition of ozone, which you have seen performed.

(In answering this question you are not to write down anything you have read from a book.)

It was evident from the answers that very few candidates had seen experiments with ozone.

The numerous failures on this paper indicate that *sufficient demonstrations have not been given to candidates.* The analytical part of the work was usually well done, though seldom in systematic form. It was evident that the plan pursued was simply intended to meet the syllabus; and confirmations of results were rather infrequent; but it is right to add that cases of fictitious testing were rare.

Advanced Stage.

1. Sulphuretted hydrogen is passed through an alkaline aqueous solution acidified with hydrochloric acid, at first there is no precipitate, then a white cloudiness is seen; the liquid is boiled and the gas again passed, when a yellow precipitate is formed.

State what salt is present, and explain these changes by equations.

Only in certain schools were the reduction and precipitation of an arsenate understood, although the phenomena were known in a considerable proportion of cases.

2. What classes of salts yield a fusible residue when strongly heated before the blowpipe on charcoal or on platinum foil?

The answers were chiefly guess work.

3. What metallic solutions undergo the following changes when sulphuretted hydrogen is passed through acid solutions:—

(*a*) First a reddish and then a black precipitate.

(*b*) First a white, then a dirty yellow, afterwards a black precipitate.

Usually answered correctly though few gave any explanations.

4. Describe experiments by which you can demonstrate (*a*) the oxidising properties of hydrogen dioxide, and (*b*) its reducing properties.

Some candidates knew so little about peroxide of hydrogen that they proceeded to point out *blowpipe* experiments that could be made with it. On the whole the answers of even the better class of candidates were less satisfactory than might be expected from the elementary character of the question.

The analytical work was generally well done, the methods employed were systematic, and the results were stated in an orderly manner. The confirmatory tests were not always satisfactorily given, and when used were sometimes not well selected. *No candidate employed the convenient and reliable wet reduction test for bismuth.*

Honours Examination.

The qualitative exercises were fairly well conducted, but the quantitative results were often very bad.

A ferric compound containing an accurately known percentage of iron was given for the determination of the metal by means of a standard solution of potassium permanganate. The actual percentage of iron present was 11·6 and some of the candidates obtained very satisfactory results, but a very large proportion made most erroneous determinations—one of them being as low as 0·25 per cent., and another as high as 60 per cent. Failure to obtain a tolerably correct result in an easy and common volumetric analysis of this kind was generally accompanied by some evidence that either the candidate had not been taught at all or had not been properly trained in the performance of such analytical operations.

Both students and teachers will do well to ponder these things over. Taken generally, Prof. Tilden clamours for (1) experimental proofs of chemical laws, (2) more attention to detail in observation. It is very evident that he suspects that chemistry is still taught mainly from books and not from observation of suitable experiments.

NOTES.

ELEMENTARY.

In the elementary stage of the forthcoming examination, questions will be set (1) on the metric system, (2) chemical equivalents, whilst a more reflective attitude towards chemical reactions will certainly be required. As an example of this, let us take the case of the preparation of an acid. Here it should be understood that the two usual ways are (1) the anhydride way, (2) the action of a strong acid on the salt of a weak one, resulting in the formation of the salt of the strong and the free weak acid. Taking the elementary course, we have the preparation of H_2SO_4 as an example of (1) because of the difficulty of finding a stronger acid with which to act upon sulphates; (2) will throw light upon the preparation of HCl, HNO_3, H_2S, H_2CO_3, and H_2SO_3, the whole of which could and should be taken together thus:—

$$NaCl + H_2SO_4 = NaHSO_4 + HCl$$
$$NaNO_3 + H_2SO_4 = NaHSO_4 + HCl$$
$$FeS + H_2SO_4 = FeSO_4 + H_2S$$
$$CaCO_3 + H_2SO_4 = CaSO_4 + (H_2CO_3) = H_2O + CO_2$$
$$Na_2SO_3 + H_2SO_4 = Na_2SO_4 + (H_2SO_3) = H_2O + SO_2$$

To these may be added the preparation of NH_3, by the action of a strong base upon a salt of the weak base NH_4.

There is no doubt about the truth of Prof. Tilden's contention that chemistry teaching tends to become mere parrot-memory work, hence the necessity for rational examination of every reaction.

Students, and even teachers, may not quite see what the Professor is driving at in his remarks under Question 2. In his 'Hints on the Teaching of Elementary Chemistry' (Longmans), Prof. Tilden answers this question himself in the following words:—'In the matter of selecting evidence great mistakes are commonly made, in many cases arising from mere indolent habit of mind or positive inability to think. A question recently set requiring evidence of the the presence of O in N_2O and NO, was generally answered by the statement that "they support combustion therefore they contain oxygen." Here "support combustion" may be assumed to refer to the combustion of a candle. In the first place, it is not true that they both support combustion; but this answer also ignores the fact that there are many known examples of burning where there is no oxygen. The proof required is as follows: Pass the gas over heated Cu, then subject the hot copper oxide to a stream of H, and show the production of water. To make the proof complete a knowledge of the

composition must be assumed, and the water must be fully identified by observation of its physical as well as chemical characters.' This craving of the Department for *minutiæ* may not be altogether excusable, but it must be met. No remarks need be made on the Advanced and Honours criticisms, as we invite questions from all who are in doubt as to any points touched upon therein.

Advanced and Honours.

Molecular Weight and Formula of Phosphoric, Anhydride, and Metaphosphoric Acid.

Prof. Tilden has been emulating the example of his predecessor in directing his attention to the compounds of P, concerning which Prof. Thorpe has done so much research work. Prof. Tilden asserts that whereas As_4O_6, Sb_4O_6, P_4O_6, $P_4O_6S_4$, and P_4S_6, have all been accurately determined by estimation of vapour density, no such accurate determination has been made with respect to phosphoric anhydride. He contends that phosphoric sulphide dissociates into phosphorus sulphide and free S, which accounts for the low vapour density obtained by V. and C. Meyer. Now, it is mainly by relying upon analogy that P_2O_5 has been accepted as the formula for the *ic* anhydride. If, then, the *ic* sulphide is not really P_2S_5 but P_4S_{10}, then P_4O_{10} must be the formula of the *ic* anhydride. Metaphosphoric acid is also claimed to be $H_6P_2O_6$ instead of H_3PO_4, the lower vapour density again being explained by dissociation consequent upon heat. Prof. Thorpe, at the meeting of the Chemical Society, practically agreed with these modifications of his successor at South Kensington.

Argon: Prout's Hypothesis and the Periodic Law.

If argon be an element its position in the periodic classification should, judging from its properties, be between Fl and Na, with an atomic weight of 20. But the specific heat ratio—1·66—points to an atomic weight of 40, if such ratio necessarily implies monatomicity. The weak point in the assumption that it does, lies in the view taken that the molecular encounters involve actual contacts, which is not a necessary assumption in the kinetic theory of gases. The greater the force of aggregation, and the smaller the distance between the atoms compared to the imaginary molecular diameter or least distance of approach, the less the tendency of internal rotation.

Conversion of Cl into HCl.

The complete conversion of Cl into HCl is brought about by passing it mixed with steam through a tube packed with coke, and heated to a faint red heat—

$$2Cl + H2O + C = 2HCl + CO.$$

Chromates and Dichromates of the Heavy Metals.

$CuCr_2O_7 + 2H_2O$.—Saturate a cold solution of chromic acid (free from H_2SO_4) with $CuCO_3$. The greenish-brown liquid which results is evaporated under the air pump, and the amorphous salt results. Heat the dichromate in a sealed tube to 220° C., and minute crystals of CuC_1O_4 result, which are insoluble in water and decompose on boiling.

The Ca and Zn compounds are obtained in the same way.

Manganous carbonate dissolves in chromic acid, but the dichromate does not crytallise out, which is also the case respecting Co and Ni.

Washing Precipitates with Boiling Water.

The water is boiled in a wash bottle, fitted with a trebly perforated indiarubber cork, the steam evaporating through an open clip. When a precipitate has to be washed the clip is closed, and the pressure of the steam at once drives the water through a tube bent at right angles connected by a few inches of rubber tubing to a jet, which is wound about with a strip of non-conducting material, and may therefore be easily handled. The bottle is also connected with an inverted flask, fitted with a tube to allow escape of air. If the pressure should become too great, the steam simply forces the the boiling water into the inverted flask. On opening the clip the water immediately returns to the lower flask.

Separation of Cr from Fe.

The old way fails when Cr is present in very small quantity. Cr is best separated by oxidising the ammoniacal precipitate of Fe, Cr, and 2Al with a few drops of HNO_3, first dropping the precipitate in a capsule before adding the HNO_3; the heating with the latter is to be continued until the evolution of chlorous fumes ceases. The Cr being thus oxidised to chromic acid, the Fe and Al can be precipitated as hydroxides with ammonia for their aqueous solution, and separated by means of caustic soda in the usual way, whilst the chromic acid can be recognised in the filtrate by means of lead acetate, after acidification with caustic acid.

Atomic Weight of Helium.

Preparation.—Hard glass tube one metre long, fitted with column 10 cm. long of $MnCO_3$, then with mixture 3 parts powdered cléveite, 2 potassium pyrosulphate, next a column 10 cm. long of CuO. Air is expelled by CO_2; CuO is heated to redness, and tube then heated as in the case of organic analysis.

The gas produced is collected over KOH, and finally passed through a tube containing layers of CuO, P_2O_5 and Mg powder, the CuO being heated to redness. The gas so prepared showed no signs of argon, nitrogen, or hydrogen. The density was determined by weighing in a 100 c.c. glass balloon. It was found to be ·139 (air 1) or 2·(H = 1). Velocity of sound in gas determined, and from this the ratio of specific heats at constant pressure and constant volume = 1·67, whereas the volume of helium contains only one atom, and atomic weight = 4.

Ba.

Detection of sulphates, sulphites, and thiosulphates in the presence of each other. Excess of $BaCl_2$ and plenty of NH_4Cl are added to the solution, which is made dilute when thiosulphates are suspected; HCl is then dropped in until $BaSO_4$ alone remains undissolved. The filtered solution is now made permanently yellow with I, when a turbidity or precipitate indicates presence of a sulphite, which has been oxidised to sulphate, whilst any thiosulphate is converted to tetrathionate; this in turn is oxidised to sulphate on adding bromine water to the clear solution, H_2S being removed at the start by CO_2.

Qualitative Determination of the Metals of the Iron Group.

The solution is mixed with NH_4Cl, and the members of the group are precipitated by NH_4OH in excess. The solution is now warmed and filtered, and the precipitate is next boiled with an aqueous solution of soda in which the alumina dissolves, and may be identified by acidifying and reprecipitating with NH_4OH.

The insoluble residue is now to be boiled with soda, and a few drops of H_2O_2 are also added. A yellow solution denotes the presence of Cr; this is acidified with $HC_2H_3O_2$, and the presence of Cr determined by means of $Pb(C_2H_3O_2)_2$. The insoluble residue is now tested for Fe by $K_4FeC_6N_6$ test. The ammoniacal solution has next to be mixed with $(NH_4)_2S$ (free from polysulphides), warmed, and filtered. The precipitate formed is next treated with cold dilute HCl to dissolve Mn and Zn, which are separated as usual. The insoluble residue is now to be dissolved in aqua regia, and after the excess of HCl has been boiled off, tartaric acid is added and a large excess of soda. From this solution the Co is precipitated by H_2S, and the precipitate may be further recognised by the borax bead test. On acidifying the alkaline solution NiS separates, and may also be tested by the borax bead test.

(To be continued.)

MATHEMATICS.

STAGES 2 AND 3, SCIENCE AND ART DEPARTMENT.

BY G. A. BAXANDALL,

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Stage 3.

Algebra.

Example 15 (*January*).—Find the coeff. of x^{15} in the expansion of $(1+x)^3(1-2x^3)^{10}$.

Solution: $(1+x)^3(1-2x^3)^{10}$

$$=(1+3x+3x^2+x^3)\left[1+10(-2x^3)+\frac{10.9}{1.2}(-2x^3)^2+\ldots\right]$$

$$=(1+3x+3x^2+x^3)[1-20x^3+180x^6-\ldots\ldots].$$

Now the only possible way in which x^{15} can arise from the product of these factors is by the first and last terms of the first factor multiplying into those terms in the second factor which contain x^{15} and x^{12} respectively. Their coefficients are therefore $(-2)^5$. ${}_{10}C_5$ and $(-2)^4$ ${}_{10}C_4$, that is, $-\frac{10.9.8.7.6}{|5}2^5$ and $\frac{10.9.8.7}{|4}2^4$. The required coeff. is the algebraic sum of these two, which is -4704.

Example XXXV. *No.* 15, *Tod.*—Show that the middle term in the expansion of $(1+x)^{2n} = \frac{1.3.5.(2n-1}{|n}\,2^n x^n$.

Solution.—There are $2n+1$ terms, hence the middle one is the $(n+1)$th, which is equal to ${}_{2n}C_n x^n$.

$$\text{Now } {}_{2n}C_n x^n = \frac{\lfloor 2n}{\lfloor n \lfloor n} x^n = \frac{1.2.3.4.....(2n-2)(2n-1)2n}{1.2.3.4.....(n-1)n \quad \lfloor n} x^n$$

$$= \frac{1.2.3.2.5.2.7.2...2(2n-1)2}{\lfloor n} x^n$$

$$= \frac{1.3.5.7.....(2n-1)}{\lfloor n} 2^n x^n,$$

since the factors of one $\lfloor n$ in the denominator cancel into the even factors of $\lfloor 2n$ in the numerator, leaving all the odd factors from 1 to $2n-1$ and the product of n two's.

It will now be necessary to consider the Binomial Theorem for the case of a negative or fractional index. This is discussed in 'Tod.' Chap. XXXVI., and in H.K. Chap. XIV. In each book what is known as 'Euler's' proof is given, but the nature of such proof does not, unfortunately, appeal to the average student. It should, however, be read, the remarks thereon being carefully considered. Whether his efforts be successful or not, he must at least make himself familiar with the fact that for all values of n, positive or negative, integral or fractional,

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{1.2}x^2 + \frac{n(n-1)(n-2)}{1.2.3}x^3 + \ldots$$

the $(r+1)$th term being $\frac{n(n-1)(n-2)\ldots(n-r+1)}{\lfloor r} x^r$.

The main type of problem is to write down any particular term of a given expansion, and for negative or fractional values of n the difficulty is in reducing the expression for the term to its simplest form. Worked-out examples will be found in the text books, but we shall give one illustration.

Example.—Obtain the 7th term of $\left(x^2 - \frac{a}{x}\right)^{-11/4}$

$$\left(x^2 - \frac{a}{x}\right)^{-11/4} = \left[x^2\left(1 - \frac{a}{x^3}\right)\right]^{-11/4}$$

$$= (x^2)^{-11/4}\left[1 + \left(-\frac{a}{x^3}\right)\right]^{-11/4}$$

$$= x^{-22/4}\left[1 + \left(-\frac{a}{x^3}\right)\right]^{-11/4}.$$

By copying from the expression for $(r+1)$th term we get

$$7\text{th term} = x^{-22/4}$$

$$\left[\frac{-11/4(-11/4-1)(-11/4-2).....(-11/4-6+1)}{\lfloor 6}\right]\left(-\frac{a}{x^3}\right)^6$$

$$= x^{-22/4}\left[\frac{(-11)(-15)(-19).....(-31)}{4^6 \quad \lfloor 6}\right]\left(-\frac{a}{x^3}\right)^6$$

$$= (-1)^6 \frac{11.15.19.....31 a^6 x^{-18-22/4}}{4^6 \quad \lfloor 6} (-1)^6$$

$$= \frac{11.15.19.....31}{4^6 \quad \lfloor 6} a^6 x^{-94/4}.$$

To find the numerically greatest term in a given binomial expansion.

Various cases are considered in 'Tod.' Arts. 510, 511, 520, or in H.K., Arts. 171, 117. In reading over these articles the student should observe the *general method* of procedure. It may be said to consist of the following *five* steps :—

(1) Express the $(r+1)$th term, and reduce the expression to its simplest form.

(2) Do the same for the rth term ; this may be deduced from the $(r+1)$th.

(3) Write down the ratio of the $(r+1)$th to the rth; put in any given numerical values, and simplify.

(4) Equate this ratio to unity and solve for r.

(5) Take the integral part of this value of r, increase it by unity, and this will give the number of the greatest term, the greatest term itself can then be found if necessary.

The reasons for these steps will be explained in the following example.

Example.—To find the numerically greatest term in the expansion of $(5-4x)^{-7}$ when $x = \frac{1}{5}$.

Solution.—

$$(5-4x)^{-7} = [5(-\tfrac{4}{5}x)]^{-7} = 5^{-7}[1+(-\tfrac{4}{5}x)]^{-7}$$

(1) The $(r+1)$th term

$$= 5^{-7}\frac{(-7)(-8)\ldots(-7-r+1)}{\lfloor r}\left(-\frac{4}{5}x\right)^r$$

$$= 5^{-7}\frac{7.8.9....(r+6)}{\lfloor r}\left(\frac{4}{5}x\right)^r.$$

This is positive, but even had it been negative we should have ignored the *minus*, since we are seeking the *numerically* greatest term.

(2) Similarly the rth term

$$= 5^{-7}\frac{7.8.9....(r+5)}{\lfloor r-1}\left(\frac{4}{5}x\right)^{r-1}$$

(3) The ratio of the $(r+1)$th to rth

$$= \frac{r+6}{r}\frac{4}{5}x = \frac{r+6}{r}\frac{4}{5}\frac{1}{3} = \left(1+\frac{6}{r}\right)\frac{4}{15}.$$

(4) Put $\left(1+\frac{6}{r}\right)\frac{4}{15} = 1$, then $r = 2\frac{2}{11}$.

(5) The $(2+1)$th or 3rd term is the greatest.

For the $(r+1)$th $= r$th $\times \left(1+\frac{6}{r}\right)\frac{4}{15}$, hence the $(r+1)$th is greater than, equal to, or less than the rth according as $\left(1+\frac{6}{r}\right)\frac{4}{15}$ is greater than, equal to, or less than unity. Now when $r = 2\frac{2}{11}$, the factor $\left(1+\frac{6}{r}\right)\frac{4}{15}$ is exactly unity, hence (if such terms existed) the $(3\frac{2}{11})$th would be equal to the $(2\frac{2}{11})$th. But these terms are impossible. If we take $r = 2$, that is, less than $2\frac{2}{11}$, it is obvious that $\left(1+\frac{6}{r}\right)\frac{4}{15}$ will be greater than unity, and therefore the 3rd term is greater than the 2nd. On the other hand, if we take $r = 3$, that is, greater $2\frac{2}{11}$, it is equally obvious that $\left(1+\frac{6}{r}\right)\frac{4}{15}$ is less than unity, and therefore the 4th term is less than the third. Hence the terms increase up to the 3rd, and afterwards diminish.

Read Arts. 523, 524, *Tod.*, or Arts. 190, 191, H.K.

Work several of the Examples on p. 321, also Exs. 29, 31, 33, 34, pp. 322, 324 in *Tod.*, *or* Exs. XIV. *a*, Nos. 9, 16, 17, 21, 23; Exs. XIV. *b*, Nos. 6, 11, 14, 15, H.K.; also the following:—

16. Write down the 5th terms of

$$(a+\sqrt{-b})^{\frac{1}{2}}, \text{and } (a^{-\frac{1}{3}} + 2x^{-\frac{1}{3}})^{-\frac{1}{2}}.$$

Ans. $-\frac{5b^2}{128a^{\frac{7}{2}}}$; $\frac{704}{625}a^{\frac{7}{3}}x^{-\frac{1}{3}}$.

17. Write down the $(r+1)$th term of $(1-x)^{-n}$, and find the condition that the sum of the coefficients of the first three terms may equal that of the fourth. Ans. $n = 3$.

18. Write down the $(r+1)$th term of $(2ax^2 - x^3)^{\frac{5}{3}}$ in its simplest form. Ans. $\frac{5.2.1.4.7...(3r-8)}{3^r\lfloor r}(2a)^{\frac{5}{3}-r}x^{\frac{10}{3}+r}$.

19. Expand $(1-x)^{-\frac{3}{8}}$, and by comparing with the series

$$1 + \frac{3}{4} + \frac{3.5}{4.8} + \frac{3.5.7}{4.8.12} + \ldots \text{ ad inf.},$$

show that the latter series is equal to $\sqrt{8}$.

20. Show that $(6-7x+2x^2)^{-1} = 2(3-2x)^{-1} - (2-x)^{-1}$, and hence show that the coefficient of x^r in the expansion of $(6-7x+2x^2)^{-1}$ in an ascending series is

$$\frac{4^{r+1} - 3^{r+1}}{6^{r+1}} \cdot \frac{1}{\lfloor r}.$$

Trigonometry.

Ex. 16 (*January*).—The right hand side of the equation was unfortunately given incorrectly. The example should have been as follows : Prove that

$$R(a^2+b^2+c^2) = abc\,(\text{cotan A} + \text{cotan B} + \text{cotan C}).$$

Solution.—R.H.S.

$$= abc\left(\frac{\cos A}{\sin A}+\frac{\cos B}{\sin B}+\frac{\cos C}{\sin C}\right)$$

$$= \frac{a}{\sin A}.bc\cos A+\frac{b}{\sin B}.ac\cos B+\frac{c}{\sin C}.ab\cos C$$

$$= \frac{a}{\sin A}\left[bc\cos A+ac\cos B+ab\cos C\right],$$

which reduces to $\frac{a}{2\sin A}\left(a^2+b^2+c^2\right)$ on putting $\cos A = \frac{b^2+c^2-a^2}{2bc}$, and similar expressions for cos B, cos C.

Hence R.H.S. $= R(a^2+b^2+c^2)$.

Ex. 17 (*January*).—We ask the reader to provide a figure.

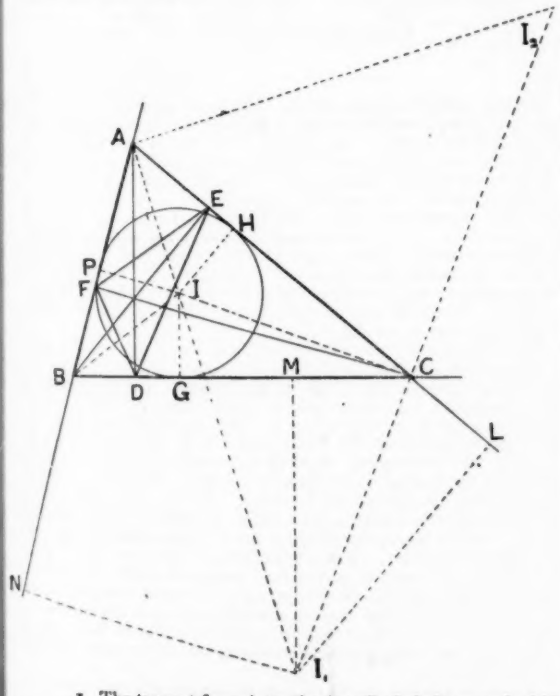
Take any point D in BC, and join AD. Draw perpendiculars from B and C to AD, meeting the latter (produced if necessary) in E and F. Produce CF to G, such that BG is parallel to DA. Let H be the middle point of BC, and θ denote the angle ADH, then :

$$BE = p,\ CF = q,\ CG = p+q.$$

$$p^2+pq+q^2 = (p+q)^2-pq$$
$$= CG^2-BE.CF = a^2\sin^2\theta-BD.\sin\theta.CD\sin\theta$$
$$= (a^2-BD.CD)\sin^2\theta$$
$$= \left[a^2-\left(\frac{a}{2}-DH\right)\left(\frac{a}{2}+DH\right)\right]\sin^2\theta$$
$$= \left(\tfrac{3}{4}a^2+DH^2\right)\sin^2\theta$$
$$= \left(\tfrac{3}{4}a^2+DA^2\cot^2\theta\right)\sin^2\theta$$
$$= \left(\tfrac{3}{4}a^2+\tfrac{3}{4}a^2\cot^2\theta\right)\sin^2\theta$$
$$= \tfrac{3}{4}a^2(1+\cot^2\theta)\sin^2\theta = \tfrac{3}{4}a^2.$$

But $S\sqrt{3} = \left(\frac{AH}{2}.a\right)\sqrt{3} = \left(\frac{a^2\sqrt{3}}{4}\right)\sqrt{3} = \frac{3a^2}{4}$.—Q.E.D.

In order to be able to work out successfully many problems on this part of the subject, it is necessary for a student to be familiar with the methods of obtaining expressions for the lengths of certain lines which are connected with a given triangle. Some of these expressions will now be found. It should be observed that these results occur in sets of three, the forms of the expressions being such that if one of a set be determined, the other two can be written down from symmetry.



1. The tangent from A to the inscribed circle, namely AH, is equal to $s-a$, since there are altogether six tangents from A, B, C, and hence the three unequal tangents, AH, CG, GB, are together equal to s, therefore $AH = s-a$. Similarly $BG = s-b$, $CG = s-c$.

2. The tangent from A to the escribed circle, centre I, namely AL, is equal to s, since

$$AL = AN,$$

and
$$AL+AN = AC+CL+AB+BN$$
$$= AC+CM+AB+BM$$
$$= 2s.$$

3. The length of the common tangent HL to the inscribed circle and escribed circle, centre I, equals

$$AL-AH = s-(s-a) = a.$$

4. From the figure it is evident that

$$AI = IH\operatorname{cosec}\frac{A}{2},\ \text{or}\ AH\sec\frac{A}{2}$$
$$= r\operatorname{cosec}\frac{A}{2},\ \text{or}\ (s-a)\sec\frac{A}{2},$$

the expressions for BI, CI being similar.

5. Similarly, $AI_1 = r_a\operatorname{cosec}\frac{A}{2}$, or $s\sec\frac{A}{2}$.

6. From 4 and 5,

$$II_1 = HL\sec\frac{A}{2} = a\sec\frac{A}{2}.$$

7. The perpendicular $AD = b\sin C$, or $c\sin B$; similar expressions for BE, CF.

8. $BD = c\cos B$; $BF = a\cos B$, and so on.

9. From 8 we get

$$FD^2 = BD^2+BF^2-2BD.BF\cos B$$
$$= c^2\cos^2 B+a^2\cos^2 B-2ac\cos^2 B$$
$$= b^2\cos^2 B,$$

hence $FD = b\cos B$; also $FE = a\cos A$, $DE = c\cos C$.

10. Since $\frac{BD}{BF} = \frac{c\cos B}{a\cos B} = \frac{c}{a}$, it follows that the angles of the triangle DBF are A, B, and C. Similar remarks hold for the triangles AEF and EDC. From this it is easy to show that the angles at D, E, F in the triangle DEF are respectively $\pi-2A$, $\pi-2B$, $\pi-2C$.

11. Let I_2, I_3 be the centres of the other escribed circles, then in the quadrilateral IAI_2C, the angles at A and C are right angles, hence the angle at I_2 is the supplement of the angle at I. But by considering the triangle IAC, this supplement is $\frac{A+C}{2}$. Now

$$I_1I_2 = AI_1\operatorname{cosec}\frac{A+C}{2} = s\sec\frac{A}{2}.\sec\frac{B}{2}\quad\text{(See 6.)}$$
$$= s\sqrt{\frac{bc}{s(s-a)}}.\sqrt{\frac{ac}{s(s-b)}}$$
$$= c\sqrt{\frac{ab}{(s-a)(s-b)}}$$
$$= c\operatorname{cosec}\frac{C}{2},$$

similarly, $I_1I_3 = b\operatorname{cosec}\frac{B}{2}$, $I_2I_3 = a\operatorname{cosec}\frac{A}{2}$.

Work the following examples :—

19. If r, r_1, r_2, r_3, R, s, S, have the meanings usually attached to them, prove that

(1) $\cot^2\frac{A}{2}.\cot^2\frac{B}{2}.\cot^2\frac{C}{2} = \frac{r_1r_2r_3}{r^3}$.

(2) $r_1 = 4R\sin\frac{A}{2}.\cos\frac{B}{2}.\cos\frac{C}{2}$.

(3) $abc = 4Rrs$.

(4) $\frac{\alpha\beta\gamma}{abc} = \frac{8R}{a+b+c}$, where α, β, γ, denote the distances of the centre of the inscribed circle from the centres of the escribed circles.

(5) $ar_2r_3 = S(r_2+r_3)$.

(6) $R = \frac{(r_1-r)(r_2-r)(r_3-r)}{4s^2}$.

(7) $\frac{r_1-r_2}{ar_1-br_2} = \frac{1}{s}$.

20. The tangents of the angles of a certain triangle are 1, 2, 3; if p_1, p_2, p_3, be the perpendiculars on the sides from the opposite angles, show that $5p_1p_2p_3 = 3abc$.

21. In the above figure prove that the diameters of the circles circumscribing the triangles AEF, BDF, and CDE, are respectively a cot A, b cot B, and c cot C.

22. If each of three circles, of radius r, touch the other two, show that the area included between the circles is nearly equal to the square upon one-fifth part of one of their diameters. (Take $\pi = 3{\cdot}1416$.)

23. If a, b, c, d, be the sides of a quadrilateral in which a circle can be inscribed, the area of the quadrilateral will be $\sqrt{abcd}\sin\omega$, where 2ω is the sum of two opposite angles.

24. Show that the area of a triangle in which the sides a, b, c, are in arithmetical progression is $\frac{b}{4}\sqrt{3(3b-2a)(2a-b)}$.

NOTES ON PHYSIOLOGY:

EMBRACING THE SUBJECTS OF THE ADVANCED AND HONOURS STAGES, SCIENCE AND ART DEPARTMENT.

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late Radcliffe Fellow, Scholar of Balliol College, and Exhibitioner in Comparative Anatomy of the London University.

Nutrition—cont.

Influence of Salts.—When animals are fed on food freed as much as possible from saline ingredients, as sodium chloride and the like, after some days they begin to exhibit signs of weakness and paralysis, which finally pass into convulsions and death. When salt is administered liberally with the food, animals drink more water, and, at first, this was supposed to explain the increase in the urea of the urine which follows. But if no water be allowed, the same increase of urea is seen, and more urine is excreted at the same time. As a matter of fact, salts do appear to induce a slight increase of proteid change.

The Influence of Alcohol.—According to earlier observers alcohol lessened the metabolism within the body, and therefore economised its energy. This was supposed to be confirmed by the fact that confirmed drunkards usually become corpulent; also in health and during fever large doses of alcohol produce a lowering of the temperature. It was believed that alcohol—readily oxidisable—passed quickly into the blood, united with oxygen, and thus spared the combustion of other substances. Then other experimenters asserted that alcohol passed through the body unchanged, and therefore could not undergo any decomposition, becoming a source of force. Small doses of alcohol given to dogs lessen the metabolism or decomposition of proteid about 6 per cent., and lessen the production of CO_2 and absorption of oxygen about 20 per cent. This is certain. But larger doses, sufficient to produce excitement and active movements, quicken respiration and the heart, and increase proteid change (5 per cent.) and the excretion of CO_2 (20 per cent. or more). It seems that the permissible dose of indulgence for men is about one ounce and a half of pure spirit daily, which corresponds to about two pints of the lighter ales.

Tea and Coffee.—These contain the same alkaloid—caffein. Careful experiments on dogs in a state of nitrogenous equilibrium have shown that the quantity of urea remains practically the same before and after the addition of a decoction of coffee to the food. But tea and coffee, undoubtedly, do produce changes in the human organism, especially in the nervous system, notwithstanding that we cannot detect any change in the metabolism. It is probable that many changes may and do occur within the nervous system, which, while they influence beneficially our dispositions and the feeling of well-being, still, at the same time, leave no recognisable trace in the consumption of material.

In the selection of articles of diet regard must always be paid to the question of the *utilisability* of the food. The nutritive value depends, *ceteris paribus*, greatly on the digestibility and utilisability of the same by the body. Cheese ranks very high when looked at from the standpoint of its composition alone, but from that of nutritive value it occupies a much lower place.

Vegetarianism.—Vegetarians assert truly that plants contain all the three essential food-stuffs—protcids, in the gluten of flour, starch, and fats in the various oils. Careful examination of the income and expenditure of a man who has lived for three years on a diet of bread, fruit, and oil showed that he had taken 50 grammes proteid daily, fats 20 grammes, and carbohydrates 500 grammes (Foster). The urine contained only 5 grammes of N per day (11 grammes urea). The striking differences are the small quantities of proteid and fat with the excess of carbohydrates. Of course this was rigid vegetarian diet. As a rule vegetarians only abstain from flesh; in other words, they partake freely of milk, butter, eggs, and cheese. In the strictly vegetarian diet above noted, the disadvantage is the small quantity of proteid and fat, and the large amount of undigested food which occurred in the excreta. In fact 30 per cent. of the fat was wasted. The question of utilisability again becomes important. For this reason also vegetable proteids are not so nutritive as those of flesh, since not more than one-half is absorbed, and the remainder leads to disturbance of digestion and disinclination for food. It has been boastingly maintained that beans, which contain 23 per cent. vegetable proteid allied to casein and called legumin, are as valuable as meat. But the percentage of this proteid assimilated is very low, and when combined with bacon, as is usual in the mixed diet of an ordinary dietary, beans form an article of food which can only be tolerated by individuals with the most vigorous digestive powers.

The Energy of Food.—The energy produceable by different foods depends on the quantity of heat evolved during the chemical changes which they undergo within the system. Albumin has a heat value equal to 5,000 units when completely oxidised to CO_2, H_2O, and nitrogen; but in the body itself it is only oxidised as far as urea, and this process yields 4,260 units of heat. With regard to fats, the heat yielded is double that of proteids; that of carbohydrates is about the same as proteid. To determine the heat evolved by an animal calorimeters are employed. A chamber is provided for the animal, which is supplied with air, and entirely surrounding it is a second chamber containing water. Outside all is a space filled with a non-conducting material like tow. The animal is kept within the chamber for a definite time, and the water is agitated, and its temperature read off.

In D'Arsonval's calorimeter there is an arrangement for keeping the water surrounding the air-chamber at a constant temperature, so that the animal is kept under the same conditions throughout. D'Arsonval employed a contrivance by which, as the temperature of the water rises, a valve opens and allows cold water to flow in. The amount thus entering is calculated, and the amount of heat developed may be estimated.

Calculating from the diet already mentioned we obtain the values—

100 grammes	Proteid	× 4,260 =	426,000	calories.
100 ,,	Fat	× 9,000 =	900,000	,,
250 ,,	Carbohydrates	× 4,000 =	1,000,000	,,
			2,326,000	

Sources of Heat—Temperature.—The temperature of man during health remains practically at 98°·4 Fahrenheit, quite irrespective of external heat and cold. Our bodies must therefore constantly be imparting heat to the surrounding air and to substances in contact. At the same time, in order to preserve the temperature, heat must be produced within the organism, and there must also be some obviously delicate internal mechanism which regulates the *loss* of heat and *production* of heat in such a manner that the temperature remains practically invariable. The temperature of the internal parts is somewhat higher than that of the skin. It is highest in the liver, and the blood of the right ventricle has a slightly higher temperature than that of the left, and this is due to the greater proximity of the liver to the right side.

In all living parts heat is produced, but since the muscles constitute at least one-half the mass of the body it is certain that they must play an important rôle in its production. The proportion of heat evolved to work done when a muscle contracts varies, but on the average it is perhaps 15 to 1. It is apparent therefore that a large proportion of the heat produced in the body must be evolved by the muscles. Next in importance come the various glands of the body, and particularly the liver and the alimentary canal during the process of digestion. In fact the blood of the hepatic vein is the warmest in the body. In warm-blooded animals, within certain limits, the temperature is independent of the surrounding atmosphere. The temperature of such an animal must depend on the relation of the heat produced within it, and the amount of heat (or heat loss) imparted to the surrounding medium. If the heat production remain constant, and heat loss increases, then the temperature falls: on the other hand, if heat loss remains invariable, and heat production be raised, the temperature will rise proportionately.

When the muscles are cut off from the nerves and central nervous system by the action of curare, a rabbit no longer maintains its temperature as before, but behaves like a cold-blooded animal, the temperature of which rises and falls with the temperature of the

surrounding air. Rise of external temperature produces increased excretion of CO_2, etc., and an increased temperature of the animal. In the above experiment the circulation remains undisturbed, and the respiration can be rendered quite as effectual, artificially, as before, the lungs and heart are therefore performing their normal functions. It seems as if curare had cut off nerve impulses passing from some part of the body which is concerned in the production of heat, and that when the muscles even are at rest important metabolic changes are taking place resulting in the production of heat, and in all probability this centre of heat production lies in the corpus striatum of the brain.

Since the body remains at a constant temperature there must also be a continual discharge of heat. This is chiefly by radiation and evaporation of sweat from the skin (80 per cent.) and lungs (12 per cent.), the remainder is taken up by warming the inspired air and the food. The rate of loss may be varied by alterations in the state of the vasomotor centre in the medulla, since this influences the condition of the blood-vessels of the skin. The warmer the surface of the body in comparison with that of surrounding objects, the greater will be the amount of interchange of heat, which implies loss of heat to the body. Since very little heat is generated in the skin itself, its temperature is intimately dependent on the amount of blood flowing through it, and this again depends on the condition of its blood-vessels. When these are dilated there is a constant supply of warm blood from deeper parts of the body. Hence dilatation of blood-vessels means an increased loss of heat.

By evaporation of the sweat, heat is lost to the skin. The loss of heat by the skin amounts nearly to 80 per cent. of the total loss from the body, and is therefore especially important. The nerve centres involved are the vasomotor centre and the centres for the secretion of sweat. But a still higher centre, probably located somewhere in the motor area of the cerebrum, must exist to adjust the activities of these centres concerned in the production (corpus striatum) and the loss (vasomotor and sweat centres) of heat in order that the result may be a persistently uniform temperature.

The Temperature of Fever.—It was formerly thought that during fever there was spasm of the vessels of the skin, and the rise of temperature which followed was due to the prevention of the loss of heat—in other words, there was heat retention. But experiments with the calorimeter have shown that the diminution of heat discharge is imaginary, that there is instead an increased discharge. It is therefore concluded that fever is due to a greater relative activity of the heat-producing processes.

Hibernation.—During sleep the higher centres of the nervous system are inexcitable. In very deep sleep the unconsciousness passes towards the medulla. Hibernation is not so much a sleep of the nervous system as a sleep of the whole body—a protoplasmic sleep. The processes of nutrition are suspended, respirations are exceedingly feeble, slow, and shallow, and the beats of the heart scarcely perceptible. The respiratory exchange of gases, CO_2 and oxygen, may be as little as $\frac{1}{30}$th of the working state, and the temperature of hibernating animals follows that of the surrounding air. By gradually subjecting rabbits to a low temperature hibernation may be simulated. On bringing the internal temperature down to 18° C., the animal becomes insensible and passes into a sleep resembling that of hibernation.

With regard to the *source of muscular energy* a few extra statements may be made. Liebig's dogma held its ground for many years, that carbohydrates and fats were heat producers, and proteids a source of muscular energy. This view was effectually disposed of by Fick and Wislicenus, two German professors, who ascended to the summit of a hill above 2,000 feet high, and made experiments upon themselves. They calculated the amount of urea excreted during the ascent, and for six hours after, and found as a matter of fact, after calculating the work equivalent to the conversion of proteid into urea, that the amount of work done was far in excess of that which could have come from the proteids. North's experiments have already told us that increased muscular exertion, unless painfully severe, is not accompanied by any excess of urea excreted, so that proteids *cannot* be a source of muscular energy. In other words, muscular energy, normally, must be dependent on the fats and carbohydrates.

If an animal be fed on proteid only, work increases the excretion of urea, since the energy must be derived from the disintegration and oxidation of proteids. In the process of *training*, large amounts of proteid are taken, fats and carbohydrates are lessened, and this seems to indicate that, after all, a muscle works best when fed on proteid than when fed on fats and carbohydates. As a matter of fact, no doubt muscle draws its energy from all the three classes of food—proteids, fats, and carbohydrates. So long as fats and carbohydrates are supplied in sufficient amount, or are present in the body as fat, glycogen, etc., the muscle utilises these for the energy expended in contraction. If, on the contrary, these foods are withheld, or present in small quantities, as after starving, muscular work must be dependent on the oxidation of proteid food.

The Fate of the Glycogen and the Carbohydrates of the Body.—The liver directly after death contains no sugar, but when removed immediately, cut up and thrown into boiling water an opalescent solution is obtained. When alcohol is added a white precipitate falls, and this substance is called glycogen. Moreover, the blood of the hepatic veins contains more sugar than that of the portal vein, and sometime after death if the liver be infused with water gives up much sugar. The glycogen has been converted into sugar by ferment action after death. Glycogen is also present in the muscles. The amount in the liver depends upon the nature of the food previously administered. Carbohydrates lead to its accumulation in the liver, proteids and gelatin slightly increase the amount over that found in a starving animal, while fats do *not* lead to the formation or storing up of any glycogen at all.

As to the function of glycogen and its fate there are several views. One assumes that it is a phase in the formation of fat; in other words, food on its way to become adipose tissue. The more likely theory is that it is a store of carbohydrate substance which keeps the average composition of the sugar in the blood constant. The arguments in favour are that the quantity of sugar in the blood is small and constant, while excess of sugar or deficiency is injurious to the tissues; normally, the blood of man and dogs contain $\frac{1}{10}$th per cent. of sugar. If this amount be increased by the injection of a solution of sugar into the blood, as into the jugular vein, the amount of sugar rises above $\frac{3}{10}$ths per cent., and the excess is rapidly eliminated by the kidneys, and appears in the urine (glycosuria). After a meal rich in sugar or starch, a large amount of sugar passes into the portal vein; many hundred grammes may thus enter the portal vein, and no trace of sugar leave the body in the urine. Again, between meals, no sugar passes into the blood, but the percentage in the blood remains the same. Evidently there must be some means by which excess is prevented, and at the same time the average percentage of sugar is preserved. This function is performed by the liver. If a solution of sugar be injected into the portal, or rather one of its branches, no glycosuria follows, but if injected into the jugular this occurs at once. In the first instance, the sugar is stopped in the liver. The latter organ seizes on the excess of sugar passing through its substance and transforms it by the active agency of its cells into glycogen, which is deposited within the liver-cells.

Glycogen is present in the muscles, and serves as a local private supply of reserve material for the evolution of muscular energy, and it is conveyed to them in the shape of sugar from the glycogen of the liver: after prolonged starvation the glycogen of the liver disappears. But much more efficacious than starvation is muscular work in causing the glycogen of the liver to disappear. If a dog be starved for a day, and then be made to do heavy work for another day, the liver then contains the merest quantity of glycogen.

Diabetes.—Under certain pathological and artificial conditions the liver loses its power of converting sugar into starch, the sugar passes through unchecked, all the tissues are supplied with it in excess, and the urine commences to contain it in abundance. By puncturing the medulla oblongata in animals between the origins of the auditory and vagus nerves, that is, within the vaso-motor centre, after a few hours the urine contains sugar, and will continue to contain sugar until the glycogen of the liver be exhausted. If the animal be starving at the time of the puncture, no glycosuria follows. In this case, therefore, the glycosuria comes from the glycogen. If a certain substance, phloridzin (obtained from the bark of the roots of apple and cherry trees), be administered to dogs, glycosuria results within a few hours, and lasts for several days. At the end of this time the liver and muscles are quite free from glycogen, and we might, therefore, think that the sugar came from the glycogen stored up. But if, when the glycosuria has stopped, another dose of phloridzin be administered, a still larger quantity of sugar is excreted. The dogs were starved at the time, therefore the sugar must have been derived from proteids. In the affection termed diabetes, the patients pass large quantities of sugar with the urine. The slighter affections (diabetes minor) are probably due to a lack of power on the part of the liver to store up glycogen, from sugar or starches entering by the mouth, and the proper and successful plan of treatment is to limit the amount of carbohydrates taken with the food. But in still graver forms, and this chiefly in younger persons, that has little influence. Even in starvation and when eating meat alone, sugar passes into the urine, and in this case it is probably due to some lack of power on the part of the tissues generally to use up the sugar brought to them, which is split off from proteids or taken in with the food. In these cases the urea of the urine is increased at the same time. It is possible that this defective power may be due to the fact that the sugar before it can be made use of by the tissues at large must be elaborated or in some way changed in certain organs of the body (Starling). Two Strasburg physiolo-

gists, a few years ago, discovered that the pancreas has powers in this direction. If this organ be extirpated in the dog, diabetes follows, which proves fatal; but if a small part of the gland is left, no diabetes results.

The Minute Structure of Muscle—The Changes, Physical Chemical, and Structural, which take place in a Muscle during Contraction—The character of a Simple and of a Tetanic Contraction—Rigor Mortis.

There are *three* varieties of muscle—striated or voluntary, unstriated or involuntary—and the muscle of the heart, which is intermediate in its properties between the two. The properties of contractile tissue have been most fully investigated in the case of striped or striated muscle. A skeletal muscle is covered with a connective tissue envelope, called the *perimysium*, which sends septa into the interior, which carry blood vessels and nerves, and at the same time divide the muscle into separate bundles. Each bundle again contains a number of muscular fibres, held together by means of a fine delicate connective tissue called *endomysium*. An ultimate fibre is about $\frac{1}{400}$ inch in diameter, and consists of a sheath or *sarcolemma*, and of the muscle-substance in the interior. The latter, as seen under the microscope, is marked by transverse stripes, in other words, by dim and bright bands. In the middle of the bright bands is a row of granules, called Krause's membrane. This is not a membrane, as a matter of fact, since the interior of a muscular fibre in the living state is semifluid. As a rule muscular fibres end in a tendon, and the ends which are convex and rounded are received into corresponding hollows of the tendon. A motor nerve enters the sarcolemma and ends in a granular débris, called an end-plate. Around the sarcolemma also is a plexus of afferent or sensory nerve fibres. When a muscle fibre, killed by osmic acid or alcohol, is examined under the microscope by means of polarised light, it is found that the dark bands are doubly-refracting, the lighter bands are singly-refracting. In the living fibre, however, nearly the whole of the fibre is doubly-refracting.

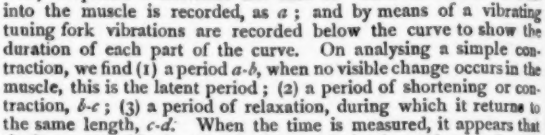
Physical Properties of Muscle at Rest.—Living muscle is very elastic, if stretched by a slight force it returns to its original length when the weight is taken off. It is not like indiarubber in this respect however, for in the latter the increase in length is proportionate to the increase in weight. In muscle, increase in weight gives rise to less and less elongation the more the muscle has been already stretched. When a muscle is in a state of contraction it is more extensible than when at rest; fatigued muscles behave in a similar way. The property of elasticity is of the greatest importance. Within the body the muscles are always slightly on the stretch, if the tendon of a muscle be divided the muscle retracts. This fact of being slightly on the stretch enables the muscles to act more quickly in response to the will.

Chemical Composition of Muscle.—When flesh taken at once from an animal just dead is frozen to about —10° C., then cut up with cold knives, pounded in a cold mortar, a snow-like powder is obtained. As the temperature rises this becomes like a syrup, which is termed muscle plasma. As the temperature rises, it coagulates just like blood, and forms a clot and a serum. The clot consists of myosin, which is soluble in 10 per cent. solution of sodium chloride and sulphate of magnesium ($MgSO_4$). In these solutions when warmed it coagulates at 56° C. It belongs to the globulin family, since it is insoluble in water, soluble in dilute salt solution, and coagulates on warming. The plasma is neutral or alkaline in reaction, on coagulation it becomes acid, and sarcolactic acid is produced.

Muscle consists of about 20 per cent. proteid, chiefly myosin; albumin and hæmoglobin are also present. Other nitrogenous bodies are present in smaller amount, namely, (*a*) kreatin ($\frac{1}{2}$ per cent), (*b*) sarcine, and (*c*) a trace of urea. Of non-nitrogenous bodies, (*a*) glycogen ($\frac{1}{2}$ per cent.), and (*b*) potassium phosphate. When finely divided meat is kept in cold water the solution is reddish. If the solution be boiled the proteids coagulate. On filtering, a clear liquid is obtained, which contains the kreatin and salts. On evaporation, a syrupy brown residue is left, known as Liebig's Extract. The latter contains no proteid.

Contraction of Muscle.—If a muscle be cut out of the body of a frog just killed and fastened to a lever it never shortens spontaneously. It may be induced to contract, however, by pinching, by applying strong glycerin or acid, or by an electric current applied to the nerve leading to it, or to the muscle itself—either the constant current or the interrupted. Such are termed stimuli, so that we may have (*a*) mechanical, (*b*) chemical, and (*c*) electrical stimuli. In the laboratory the usual stimulus employed is the interrupted current, as it is easy to regulate its strength and duration.

The Changes which occur on Contraction—1. *Physical Changes.*—These consist in a change of form. It becomes shorter and thicker, but its volume remains the same. In order to study the effect more closely, the muscle is made to record its contraction graphically on blackened paper. The gastrocnemius, with the sciatic nerve and femur are usually selected. The bone being grasped firmly in a clamp, the electrodes of the battery applied to the nerve, and the tendon of the muscle fastened to a light lever, which is furnished with a bristle or a small pointed piece of stiff parchment which is arranged in contact with the surface of a blackened piece of paper attached to a cylinder. The latter is made to revolve steadily by a clockwork apparatus. When the current is sent in the lever is jerked up, and falls again, describing on the paper a muscle-curve.



By a special contrivance the time at which the shock is sent into the muscle is recorded, as *a*; and by means of a vibrating tuning fork vibrations are recorded below the curve to show the duration of each part of the curve. On analysing a simple contraction, we find (1) a period *a-b*, when no visible change occurs in the muscle, this is the latent period; (2) a period of shortening or contraction, *b-c*; (3) a period of relaxation, during which it returns to the same length, *c-d*. When the time is measured, it appears that the latent period is about $\frac{1}{100}$th of a second, the shortening $\frac{1}{10}$ths, and the relaxation $\frac{8}{10}$ths of a second. In other words, a single contraction or twitch occupies about $\frac{1}{10}$ of a second. If a muscle be stimulated a second time, so that the shock is sent in during the period of shortening, we get a double contraction; in other words, the second contraction is piled up, as it were, on the first. This is termed summation. If a muscle be stimulated many times in succession so that it has no time to relax at all, we get a prolonged contraction, all the stimuli sum together, and the result is a much more extensive contraction. The state of contraction is called tetanus, and in the case of frog's gastrocnemius tetanus follows with 20 stimulations per second.

Electrical Changes during Contraction.—If a delicate galvometer be connected with two points on the surface of a living muscle, as the middle and end, it is found that there is a weak electric current from the end to the middle. When the muscle enters into contraction this current is diminished, or suffers what is termed a negative variation. This negative variation occurs at the very commencement of contraction, and lasts only about $\frac{1}{200}$th of a second.

Production of Heat and Chemical Changes during Contraction.—When a frog's muscle is tetanised for two minutes, by means of a delicate thermopile it may be shown that there is a very slight increase of temperature, perhaps as much as one-fifth of a degree centigrade. In larger animals the increase of temperature is more easily shown. The bulb of a thermometer is placed between the muscles of the thighs, and the spinal cord is stimulated. It has been proved that (1) more heat is developed in a strong contraction than in a weak one; (2) more heat is produced if the muscle does no work than when actual work is performed; (3) when muscle becomes exhausted, both the work done and the heat generated decline, but the latter more quickly. When a muscle contracts there is an increased formation of CO_2 and sarcolactic acid, and an increased consumption of oxygen, but not nearly to the same degree as the increase of CO_2. During contraction the muscle probably makes use of some form of carbohydrate, *glycogen* or *sugar*, yielding as waste products CO_2 and lactic acid. Certainly, the blood leaving the veins of muscles during contraction contains less sugar than that entering them.

Fatigue.—Muscles are incapable of contracting for an indefinite time. They become fatigued and finally exhausted, so that the strongest stimulus fails to produce a response. In fatigue the muscle curve has a longer latent period, the height of contraction is not so great, and the length of the curve is much more. If left to itself the muscle will recover, and much more quickly if a stream of blood, or even of solution of salt, be passed through its vessels. Fatigue depends on two factors, (*a*) the accumulation of waste products—as lactic acid, and the reviving effect of blood acts in two ways, it brings oxygen, and removes the CO_2 and products of waste; (*b*) in the consumption of the contractile material on which the energy of the muscle depends.

Voluntary contractions differ from an ordinary contraction, since a single voluntary contraction is made up of several—in fact, it is a tetanus. There is a rhythm of about nine contractions per second.

Rigor Mortis.—After the death of the body (or after ligature of the blood-vessels which supply a muscle) the muscles become rigid and stiff. They become shorter and thicker, and an evolution of heat occurs. The onset of rigidity in man varies from a few minutes to several hours, according to circumstances, and it lasts three or four days. The muscles of the head and neck enter into rigor first. Afterwards the effect passes off, and the muscles become soft again.

comparison has been made between *rigor mortis* and contraction, ir each is accompanied by a development of CO_2 and acid reaction, nd by an evolution of heat. In each, moreover, a shortening and ickening of the muscles takes place. But there are differences, ince a muscle, when it passes into rigor, becomes less elastic, less xtensible, and opaque.

Smooth or Unstriped Muscle.—Unstriped muscle exists in the lood-vessels, the intestine, etc. When stimulated by means of an lectric shock, after a latent period of about $\frac{1}{10}$ of a second, there s a slow contraction which may last 90 seconds. When the ntestine is stimulated in this manner a contraction forms at the ne, which travels as a wave (peristaltic wave of contraction) nwards and downwards. We may thus compare smooth and triped muscles :—

	Latent period.	Length of contraction.	Tetanus.
Smooth	$\frac{1}{10}$ second.	90 seconds.	12 shocks per minute.
Striped or striated	$\frac{1}{100}$ (or less) second.	$\frac{1}{10}$ second.	20 shocks per second.

The cardiac muscle stands intermediate. It possesses *par excellence* the power of rhythmic contraction, which may also be exhibited by the others under special conditions.

SCIENCE NOTES.

THE NEW PHOTOGRAPHY.—At a recent meeting of the Paris Academy of Sciences, M. H. Murat, of Havre, gave an interesting account of results similar to those of Röntgen obtained by the use of ordinary light. A sheet of copper having been placed in a photographic printing frame, the object to be photographed is put next to it, and then the sensitised gelatine plate. The frame is afterwards placed on a large sheet of copper, then covered with a sheet of lead, and the overlapping edges of the copper and lead sheets are folded over so as to enclose the frame completely, thus excluding ordinary light rays. After exposure of the whole to sunlight or lamplight however, and the subsequent development of the plate, distinct images are obtained of a similar nature to those of Röntgen. It has been found by M. Le Bon, that electricity is generated during the formation of the photographic image, and Professors Pighi, Bergmann, and Bergim, find that the Röntgen rays have the property of electrically charging an insulated body even if sheltered by means of a Faraday screen.

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PAPER-MAKING IN COREA.—The best so-called 'China and Japan' paper is the produce of Corea. It is entirely hand-made, no kind of machinery being used in its production. The raw material for the better kinds is obtained from the bark of *Broussonetia papyrifera* which is collected in spring and beaten in water containing a large admixture of wood ashes till reduced to thick pulp. Then it is taken in large ladles, and spread upon frames of bamboo, so as to form thin sheets. Another kind of paper is made from scraps of old paper trodden into pulp in much the same way as grape juice is expressed in some countries, and though this process of pulping is slow, it has the advantage of not breaking the fibre so much as one when machinery is used. After the pulp has been made into paper the sheets are piled up to a height of six feet and then cut into pieces, to be again subjected to the stamping with the feet. At the same time the root and seeds of a plant called 'tackpoul' are added, the soluble parts of which are supposed to give tenacity and toughness to the paper.

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AUSTRALIAN FUNGI.—An interesting contribution to our knowledge of Fungi has been made by D. Macalpine. He has carefully tabulated all the Australian Fungi known up to the end of the year of 1894, and finds that the total number of species amounts to 2,284. West Australia contributes 242, South Australia 262, Tasmania 339, Victoria 1,070, New South Wales 406, and Queensland 1,060. He now proposes to put on record all Fungi that come under his notice, whether they are new to science, new to Australia, new to particular colonies, or are found in new localities or on new host plants. He expects thus to supply means for the discrimination of species and their correct classification, leaving vegetable pathologists to supply the requisite practical application of this knowledge by studying the life history of the Fungi and their influence upon the well-being of other plants. Mr. Macalpine has classified the species so far known, has described several new species, and has illustrated their spores.

A NEW THEORY OF SIGHT.—For ten years H. M. Bernard has been engaged in endeavouring to find an explanation of light sensations, and now proposes a theory which he considers is capable of connecting and explaining most of the phenomena. He is engaged in arranging the evidence with which he hopes to demonstrate it. For the present he thus briefly describes the development of visual organs in the animal kingdom :—Under the influence of light certain organisms travelling toward the light seek either to leave the Metazoan body altogether, or else to discharge their contents at the surface. Such emigration cannot take place without the cognisance of the nervous system, and in the most frequented illuminated parts of the body complications arise between the fugitives and the other tissues, notably the peripheral nerves. Bernard's suggestion is, that out of these complications all the known eyes of the animal kingdom, the most complicated as well as the most simple, have arisen in one way or another.

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A NEW WASTE PRODUCT.—A liquid to which the name of lignosulphite has been given is obtained in the production of wood pulp for paper-making, by treating pinewood with a boiling solution of lime and sulphurous acid. The liquor extracts ethereal oil, resin, and the balsamic constituents of the wood, as well as other substances produced by the action of sulphurous acid, and it has an agreeable aromatic odour. Dr. Hartmann, Professor Schrötter, and other Austrian physicians, are using this substance for inhalation in the treatment of diseases of the lungs and respiratory organs.

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VEGETATION AND THE SOLAR SPECTRUM.—Flammarion has recently studied the action of the different rays of the solar spectrum upon sensitive plants. The houses in which the plants were grown were glazed with red, green, and blue glass respectively, others being kept under ordinary white glass to serve as a check. The growth in height of these plants was found to follow this order :—Red, green, white, blue, the difference being very marked in the case of the red. The action of red light was also most pronounced as affecting the vigour and activity of vegetation, white coming next in this case, then green, and blue again last. Red light is described as exerting a similar effect to that of a chemical manure, while under blue glass development was almost stationary.

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THE PREVALENCE OF BORIC ACID IN NATURE.—Some recent observations of H. Jay as to the prevalence of boric acid in Nature are of special value in connection with the use of the acid as an antiseptic in articles of food. The ash of fruits were found to contain from 1.5 gm. to 6.4 gm. of boric acid per kilo. The plants which seem to absorb the acid with the least facility are the cereals—wheat, barley, rice, and rye—certain Fungi—*Champignons de couche*—and cress, not more than 0.5 gm. being found per kilo of ash in those cases. The urine, milk, and blood of various animals have been examined for boric acid, but it was found in the urine only—to the extent of 0.0086 gm. per litre in that of the cow, and 0.0075 gm. in that of the horse. Boric acid is distributed over the chief part of the globe, if not the whole. Both wild and cultivated plants absorb it from the soil and water whenever they meet with it. What is still more important, the acid is not assimilated when introduced into the animal stomach in small quantities, but is eliminated with the excretions.

***

ANTS AND SURGERY.—A large species of ant, *Camponotus*, is employed by the Greek surgeons of the Levant for holding together the edges of an incised wound. The ant, when held with forceps, opens it mandibles wide, and seizes the edges of the cut, which are held together for the purpose. As soon as a firm grip is obtained, the head is severed from the body. Mr. Issigonis of Smyrna in a communication on this subject lately made to the Linnæan Society states, that he has seen natives with wounds in course of healing with the assistance of seven or eight ants' heads.

NOTES ON THEORETICAL MECHANICS.

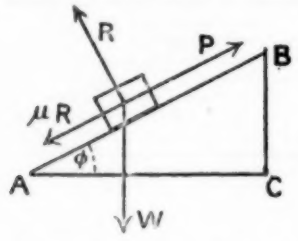
ADVANCED AND HONOURS STAGES.

BY F. CASTLE, M.I.M.E.

Continued from page 441.

Rough Inclined Plane.—Let the inclination of the plane be denoted by ϕ, and let a body of weight W be just on the point of moving *up* the plane, under the action of a force P (P being parallel to the plane) ; μ the coefficient of friction, the force of friction of

magnitude μR (always acting in the opposite direction to that in which motion is about to take place) will act down the plane. To



find the relation between P and W, we have, resolving the forces parallel and perpendicular to the plane,

$$P = \mu R + W \sin \phi, \quad (1)$$

$$\text{and } R = W \cos \phi. \quad (2)$$

Substituting the value of R from (2) in (1), we get :—

$$P = \mu W \cos \phi + W \sin \phi.$$

$$\therefore P = W (\sin \phi + \mu \cos \phi). \quad (1)$$

If the body were just about to slide *down* the plane, the direction of friction would be reversed, and equation (1) becomes :—

$$W (\sin \phi - \mu \cos \phi).$$

Equation (1) may be obtained very simply by the *principle of work*. When the body is moved from A to B, work must be expended on gravity and on friction; since the height BC is the distance through which the body is lifted, the work expended on gravity is $W \times BC$, or—

$$W \times AB \sin \phi.$$

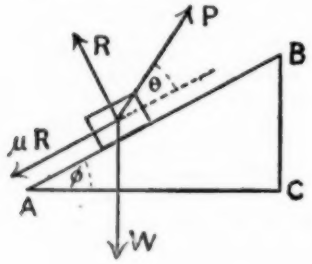
The pressure R on the plane is $\frac{W \times AC}{AB}$, thus the friction is $\mu \times \frac{W \times AC}{AB} = \mu W \cos \phi$, and the work expended on friction is $\mu W \cos \phi \times AB$.

Hence the whole work expended on W is—

$$W \times AB \sin \phi + \mu W \times AB \cos \phi.$$

$$\therefore P \times AB = AB \times W (\sin \phi + \mu \cos \phi),$$

$$\text{or } P = W (\sin \phi + \mu \cos \phi).$$



When the force or power P makes an angle θ with the plane, resolving along the plane, and perpendicular to it, we have—

$$W \sin \phi + \mu R = P \cos \theta, \quad (1)$$

$$\text{and } R - W \cos \phi = -P \cos \theta. \quad (2)$$

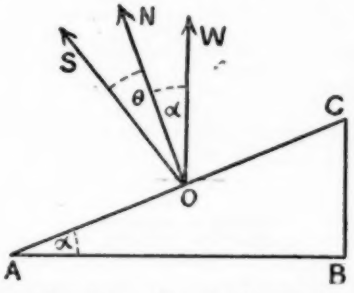
Eliminating R, we get from equations (1) and (2) :—

$$W (\sin \phi + \mu \cos \phi) = P (\cos \theta + \mu \sin \theta),$$

$$\therefore \frac{P}{W} = \frac{\sin \phi + \mu \cos \phi}{\cos \theta + \mu \sin \theta}.$$

If the body is on the point of moving down the plane, then—

$$\frac{P}{W} = \frac{\sin \phi - \mu \cos \phi}{\cos \theta - \mu \sin \theta}.$$



The Screw with Friction.—The triangle ABC shows one turn of the screw unwrapped.

BC the pitch of the screw, and AB the circumference of the screw thread $= 2\pi r$, where r is the radius of the screw.

Let W denote the weight raised, and P the force applied at the end of a lever of length l.

θ the angle of repose, S the reaction of the screw, making an angle θ with the normal ON, and α the inclination BAC of the screw thread.

The vertical component of S is $S \cos (\alpha + \theta) = W$.

The horizontal component of S is $S \sin (\alpha + \theta)$.

Now the horizontal component of S, and the force P for equilibrium, must have equal moments about the axis of the screw; this gives—

$$P \times l = S \sin (\alpha + \theta)\, r,$$

$$\text{also} \qquad W = S \cos (\alpha + \theta).$$

$$\therefore \frac{Pl}{W} = \frac{S \sin (\alpha + \theta)\, r}{S \cos (\alpha + \theta)},$$

$$\text{or} \qquad \frac{P}{W} = \frac{\tan (\alpha + \theta)\, r}{l}.$$

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Jackson's System of Upright Hygienic Penmanship. Wall Charts for Class Teaching. London: Sampson Low, Marston & Co., Limited.

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First Steps in Harmony. By Ralph Dunstan, Mus. Doc. (Cantab.). London: J. Curwen & Sons, Warwick Lane.

Musical students are greatly helped now-a-days by numbers of excellent and comprehensive text-books in all branches of the science. Almost every composer of note has brought out something or other in this line. Take harmony for instance. We have had standard works by Goss, Ouseley, Stainer, Macfarren, Prout, Gadsby, Oakley, etc., and now before us we have another treatise on the same subject.

Messrs. Curwen & Sons have certainly produced a neat and handy volume. The paper and print are excellent; the whole of the examples being in the old notation. The work only requires looking at to be appreciated. Dr. Dunstan's name is already well-known to teachers—being Lecturer on Music at the Westminster and Southlands Training Colleges. He is also Head of the Music Department, Battersea Polytechnic Institute.

The book is divided into ten chapters, the first being on scales, scale-relationships, intervals, etc. Then follow triads and common chords, rules for harmonising melodies, inversions of triads, chord of the dominant seventh and its three inversions, suspensions, diminished and augmented triads, prepared discords and figured basses.

We have no hesitation in thoroughly recommending Dr. Dunstan's work. The author has spared no pains to make everything clear and simple. The rules throughout are printed in a thicker type than the rest, which enables the student at a glance to retain them in his memory.

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These are merely suggestions, which the author might perhaps be inclined to carry out in a second edition. Dr. Dunstan has certainly produced an excellent book, and one which will prove really helpful to teachers who desire to obtain high marks at the Certificate Examination.

Mammals of Land and Sea. By Mrs. Arthur Bell. London: Geo. Philip & Son.

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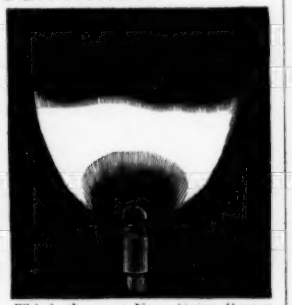

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Architects of Fate, or Steps to Success and Power. By Orison Swett Marden. London: Thomas Nelson & Sons.

We understand that an earlier and somewhat similar book by the same author as the one before us, has had in the United States a sale of 60,000. Coming on the heels of such a record, 'Architects of Fate' is bound to challenge attention. The title as well as the book itself is of American origin, for it is taken from the striking stanza of Longfellow's :—

'All are architects of fate
Working in these walls of time,
Some with massive deeds and great,
Some with ornaments of rhyme.'

The object of the work is thus described in the title-page :—'A book designed to inspire youth to character building, self-culture, and noble achievement.' This object the author seeks to attain by the rapid, vigorous, and stimulating statement of numerous examples of courage, perseverance, and patience in struggles with difficulties such as beset the path of the young, but which true manhood regards only as things to be overcome, as incentives to more determined endeavour. As a collection of telling anecdotes from biography and history, classified under suitable headings, connected by inspiring comment, and pointed by apt and abundant quotation, this stout volume should prove most attractive and helpful, especially to boys and young men. It is so vivacious in its manner that it could be taken up with pleasure at odd moments, or read continuously at leisure. It is most admirably suited for a prize to a boy leaving school, and should be placed in circulation in every library accessible to young people. Presenting a handsome and tasteful exterior, the book is also capitally printed, and illustrated with full-page portraits.

The Unrivalled Atlas. Messrs. W. and A. K. Johnston: Edinburgh and London.

This Atlas, containing 40 large maps with numerous insets and diagrams, is one of the best we have seen for ordinary purposes. The fact that it has attained its 21st edition, is sufficient evidence of its sterling worth. The maps are very full, well-printed and coloured and quite up to date, as will be seen by consulting the map of South Africa. An index to some twenty thousand names is added. The only point we notice which is incorrect is the diagram of the Solar System, where the number of asteroids is given as 224 instead of 420; Jupiter has five moons, and not four, and the distances of the various planets are not up to date.

On the whole, the Atlas is one which we can safely recommend.

Familiar Scenes for Object Lessons: The Fire Engine; The Lighthouse; The Diver; The Balloon. Messrs. W. and A. K. Johnston.

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The Cornhill Magazine. London: Smith, Elder, & Co.

The 'Cornhill' is always good reading. The numbers for January, February, and March contain the first dozen chapters of a new serial entitled 'Clarissa Furiosa,' by W. E. Norris. 'Impressions of a First Night'; 'The Dane at Home'; Burma; 'In the Land of the Claret,' are among the interesting articles which appear in January and February. The March contributions are above the average, and on the whole the number is an exceptionally good one. 'Photographing the Unseen,' with a full page illustration, is an ably written article by A. A. C. Swinton. 'The Way to the North Pole' is good, and the subject indicated by the title of the paper is dealt with by a master hand. Teachers who read this will, like ourselves, regret that the author's name does not appear. Mr. Crockett's 'Cleg Kelly' comes to an end, and a new serial story by James Payn, entitled 'The Disappearance of George Driffell' is announced for April. Our readers will do well to order this excellent monthly.

German Composition, with Notes, and a Copious Selection of German Idioms and Familiar Phrases. By F. Hundel, Professor of German at Pitman's Metropolitan School of Shorthand. Hirschfeld Brothers, 22 and 24, Bream's Buildings, Fetter Lane, E.C.

This is a collection of English extracts in various styles for translation into German. Many of the extracts are from well-known English writers. An advanced student of German would be able to derive much profit from this book, but the notes are too scanty for any but students who have read much German. The collection of familiar phrases and proverbs will be found very helpful to students who are aspiring to speak German.

French Verbs Classified and Arranged for Learning. By the Rev. W. Wakeford, B.A. London: Relfe Bros.

This is a large folded card, exhibiting on its four pages the four stages of a method of learning the French verbs. The first stage includes six lessons on the Regular and Auxiliary Verbs, with exercises for practice; the second gives tables of semi-irregular verbs; the third provides practice on the models given in the second; and the fourth stage shows the various forms of the irregular and defective verbs. The arrangement forms a useful help for the memory-work of French Grammar.

The Preceptors' Junior French Course. By Stephane Barlet, B. ès. Sc. Univ. Gall. London: Relfe Bros.

The course of instruction here laid down is intended to afford preparation for the College of Preceptors' Examinations of Junior Classes, and other examinations of similar difficulty. It includes a sufficient amount of the grammar well arranged, clearly stated, and fairly illustrated with examples. Each chapter contains exercises for practice, and these possess the special merit in most cases of forming something like a continuous narrative or a piece of conversation on some definite subject. English passages are given for re-translation, as well as sets of questions to test the pupil's knowledge of the grammar. We noticed one or two misprints. Thus, Exercise 28 is numbered 25, and its first sentence is open to question: '*Le dimanche est le dernier jour de la semaine, et le lundi est le premier.*' Still, the book is well printed on the whole, and we feel quite warranted in recommending it as likely to serve its purpose satisfactorily.

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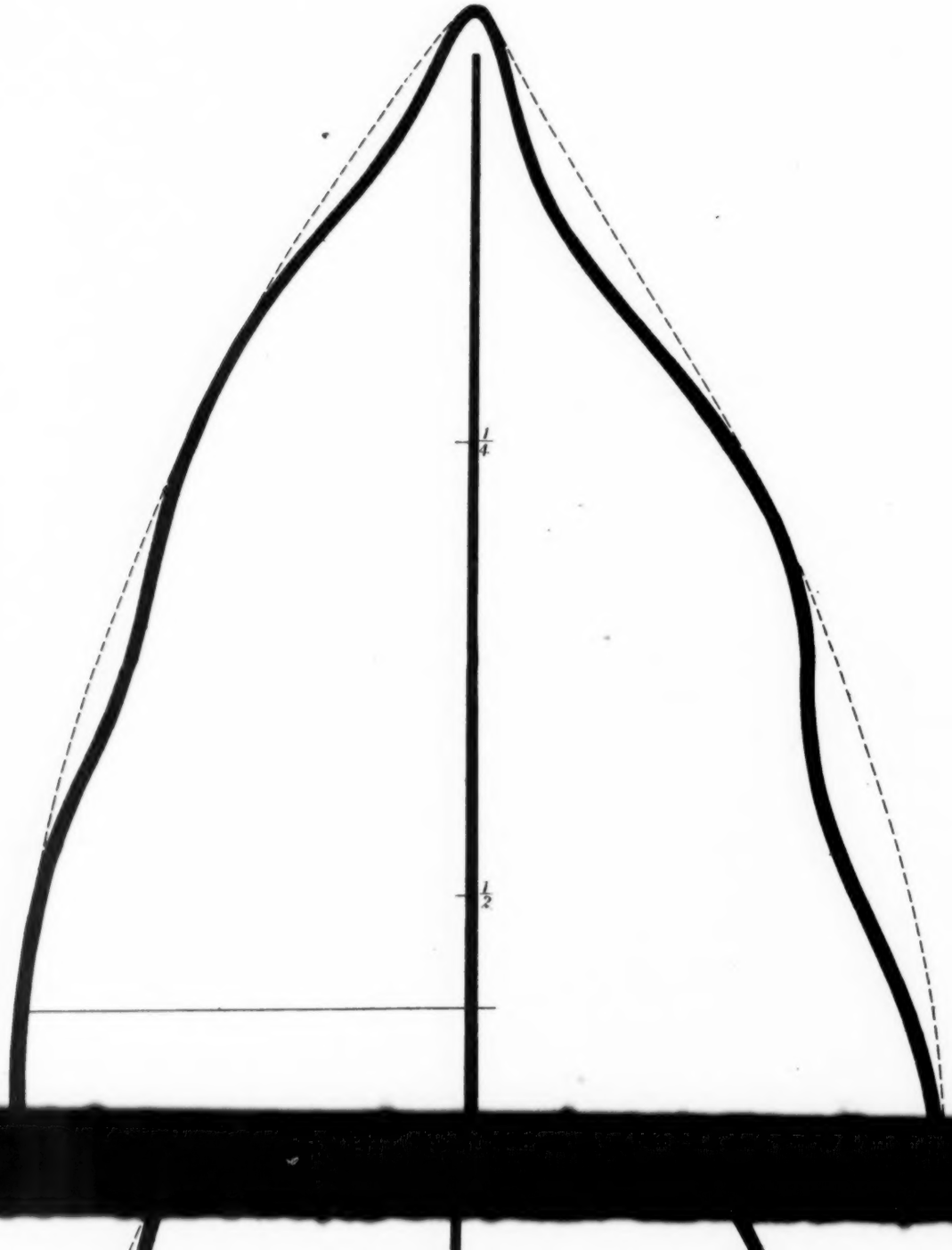

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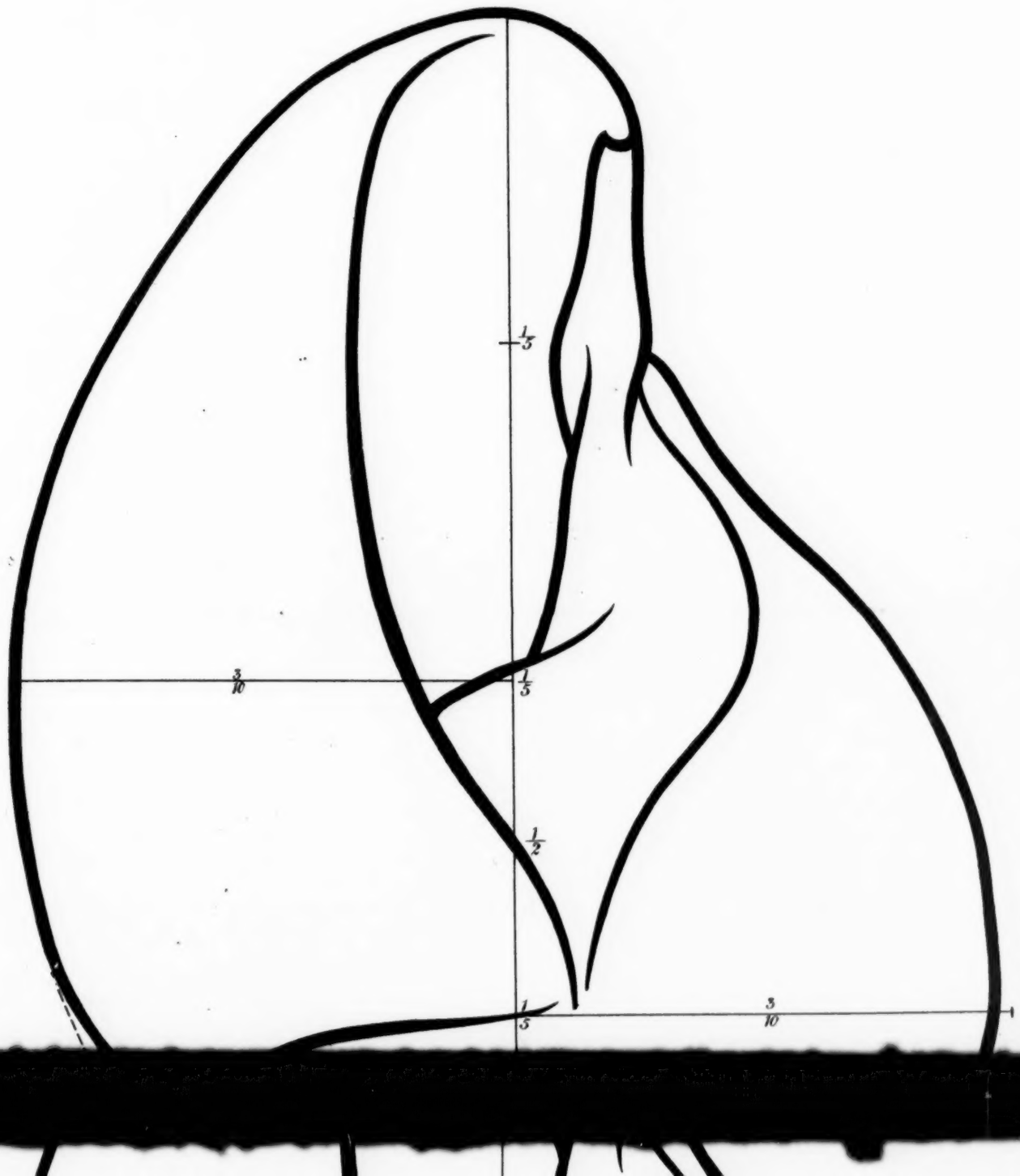

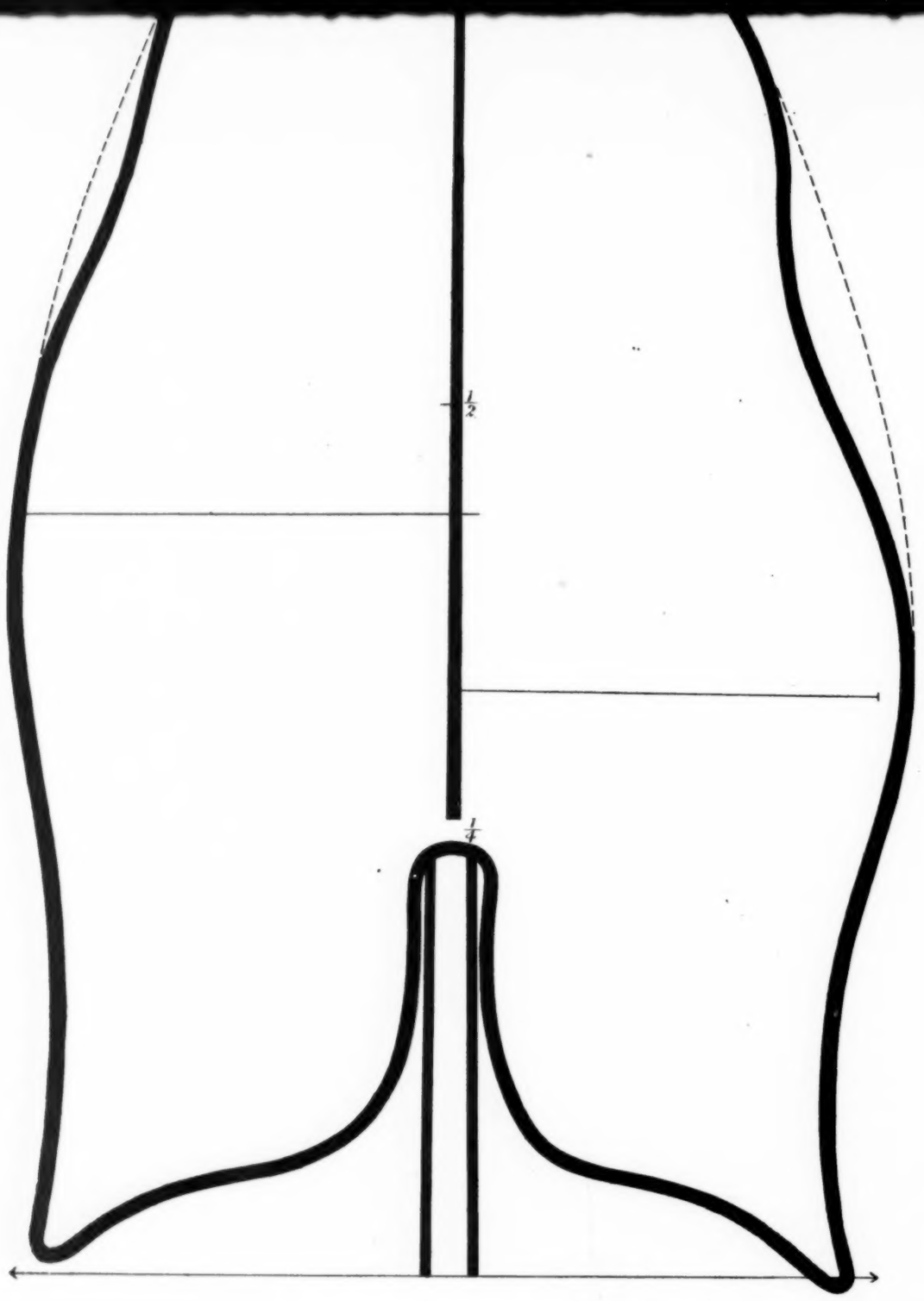

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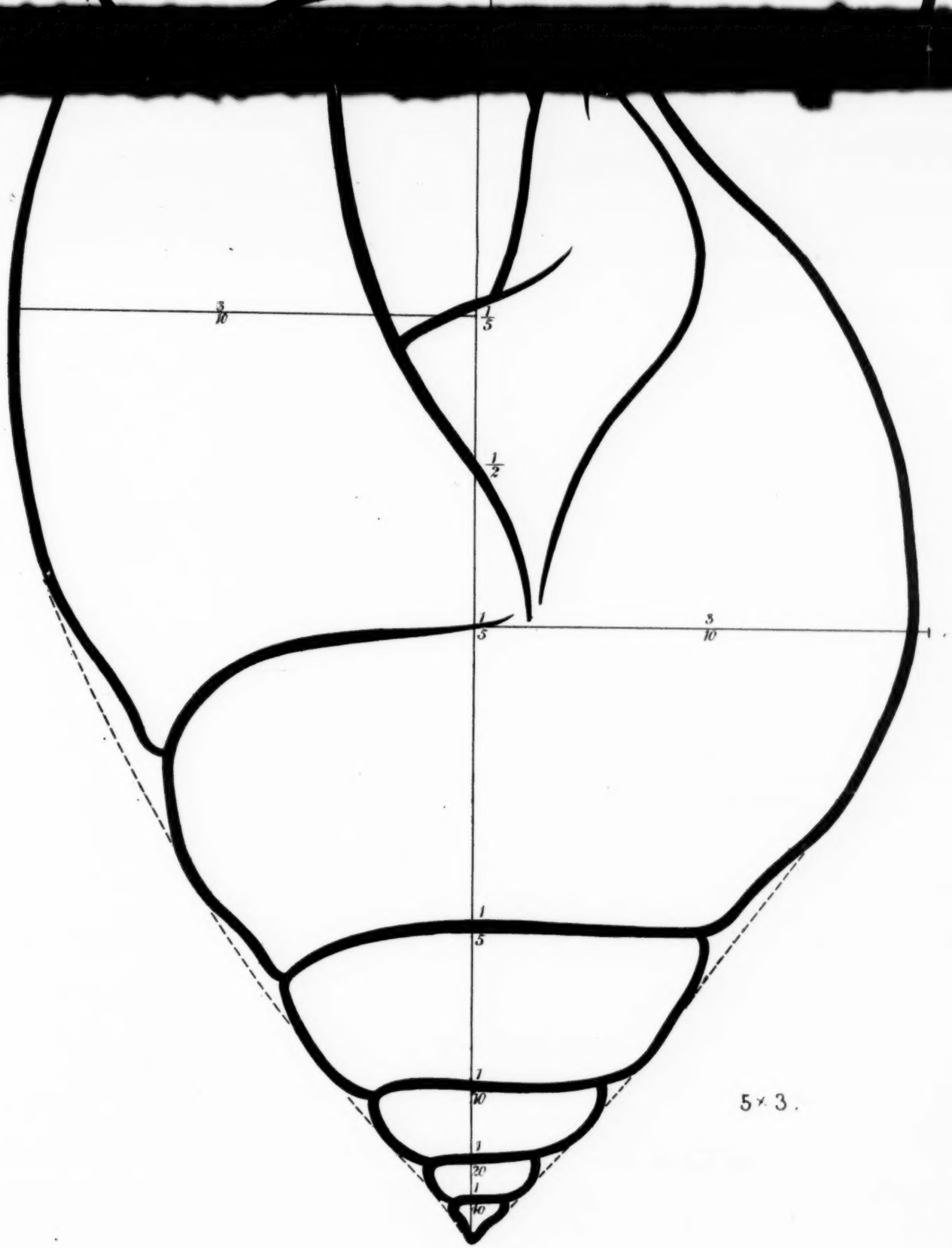

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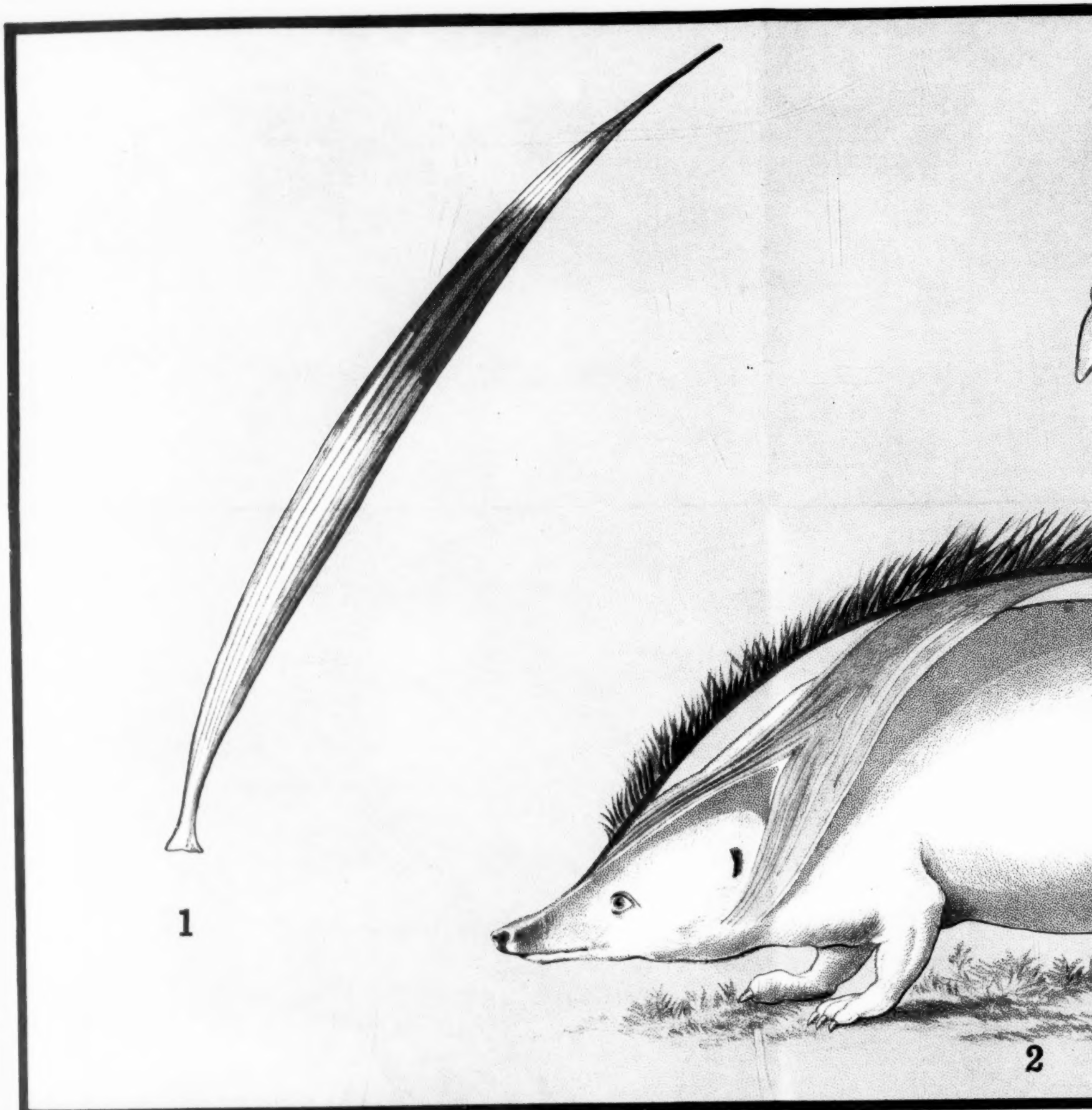

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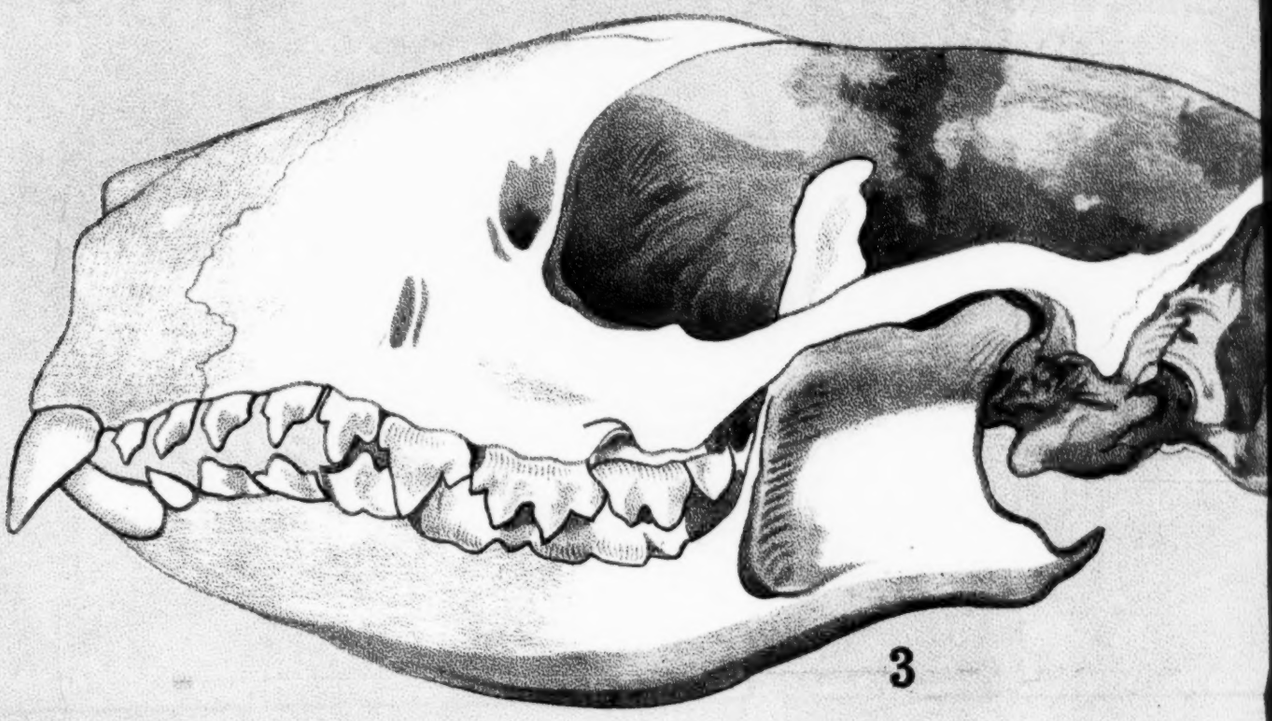

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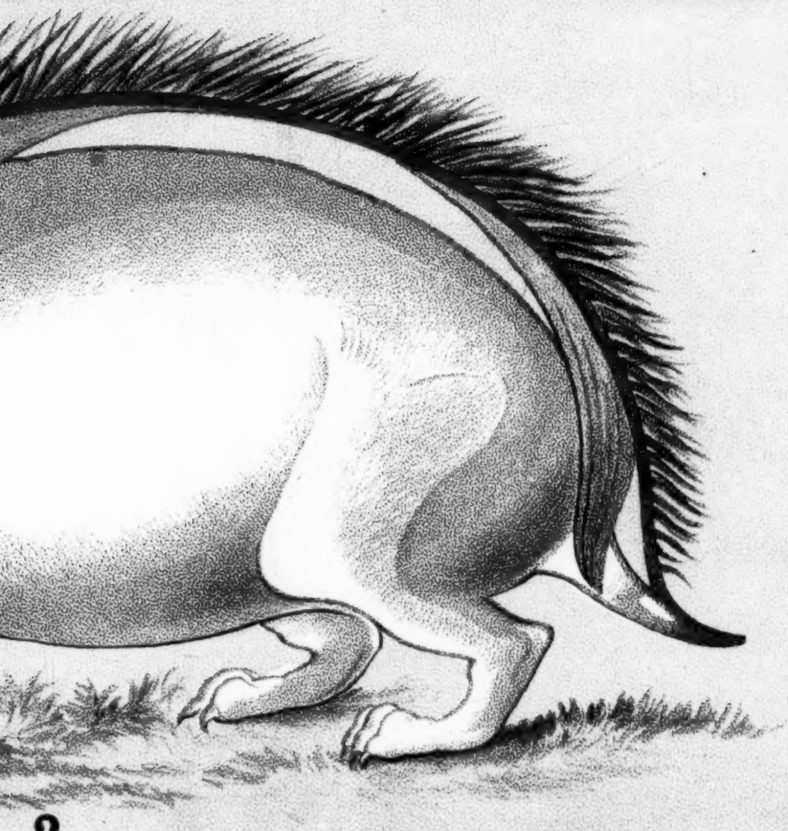

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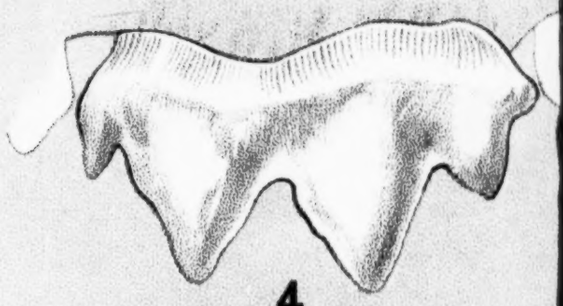

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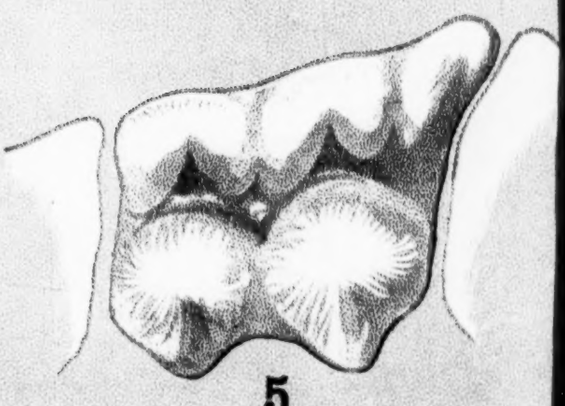

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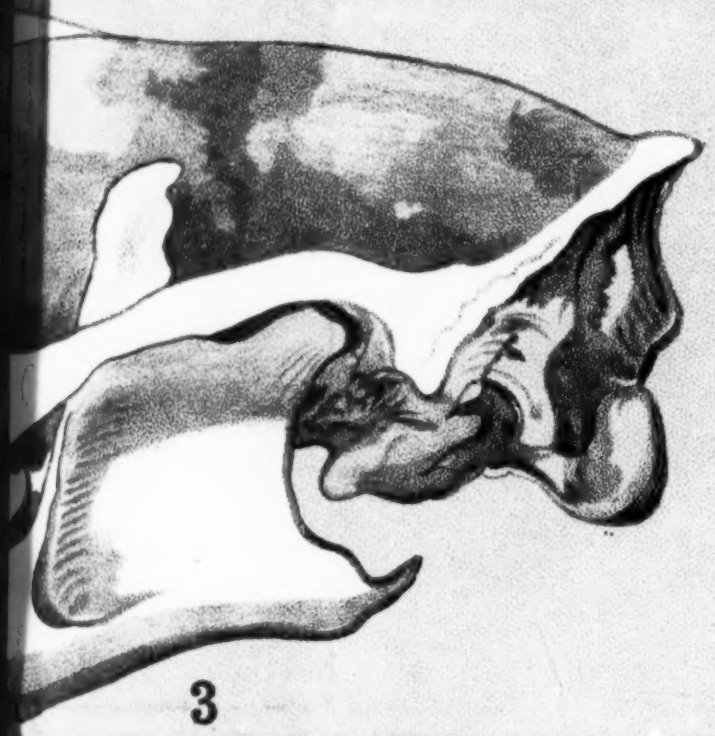

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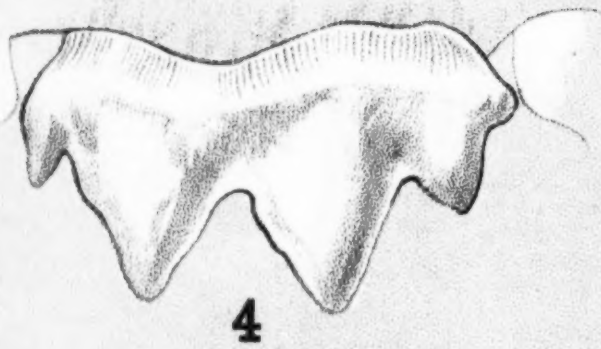

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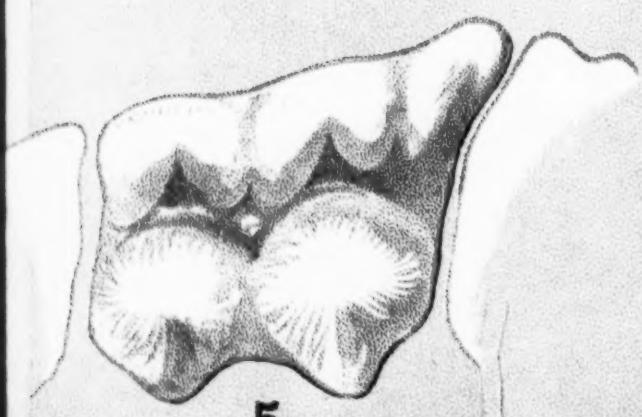

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6. **Mouth, under side, showing projecting nose, teeth, etc.**
7. **Forefoot of Hedgehog.**

GENERAL DESCRIPTION OF THE HEDGEHOG.

The Hedgehog is a good representative of the Insectivorous order of animals—that is, animals which subsist on insects, worms, slugs, small reptiles, or even on the eggs of ground-building birds, such as the quail, partridge, or lark.

The most characteristic structural parts of the *Insectivora* are the teeth. In the Hedgehog and the Shrew, the incisors project considerably, thus facilitating the picking up of small beetles, etc. The molar teeth are pointed, with three or five sharp cusps. Small collar-bones (clavicles) are present. There are five toes on each foot, with pointed nails. Some insectivorous animals are arboreal, such as the Malaysian Tree Shrew; others jump considerable distances upon the loose sand, as the African long-nosed Elephant Shrew; and several burrow in the ground. The majority are, like our own Hedgehog, entirely terrestrial.

The body of the Hedgehog is well covered with short but extremely sharp spines, which are an effective protection against enemies. When the Hedgehog anticipates danger, it rolls or doubles itself up into a prickly ball. This is accomplished by a special series of muscles (the paniculus) which draw the roots of the spines backwards, and cause their points to project in every direction. When the danger is over, the animal unrolls itself, the muscles relax, and the spines resume their usual position. The Hedgehog hibernates or sleeps during winter, selecting for its retreat a burrow concealed under rocks, or under the roots of a tree, and well lined with dry leaves.

The Hedgehog is found in Britain, sparingly in Ireland, and extends over Europe eastwards to China. The young are born blind, and are covered with soft hair instead of spines. Tame Hedgehogs are sometimes kept for the purpose of destroying black beetles in houses. A curious fact about the Hedgehog is its immunity from poison. The bites of poisonous reptiles, and even the eating of poisoned food, cause it no inconvenience.

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PRINTED BY EYRE & SPOTTISWOODE, *Her Majesty's Printers*, DOWNS PARK ROAD, N.E., PUBLISHED BY THE PROPRIETORS AT THE OFFICE OF 'THE PRACTICAL TEACHER,' 33, PATER ROW, LONDON, E.C.